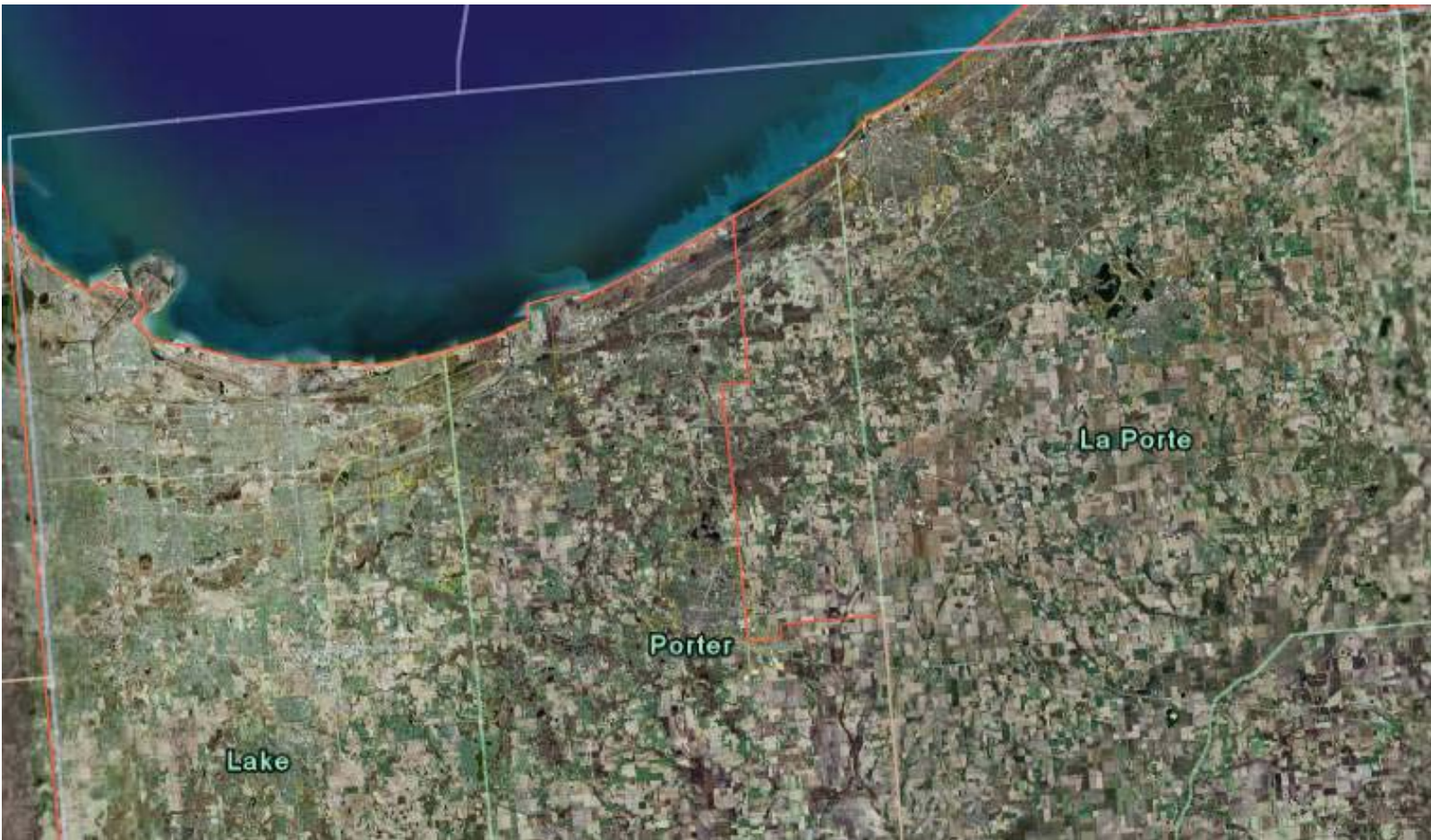


Coastal & Estuarine Land Conservation Program Plan



For the State of Indiana



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Indiana's Coastal and Estuarine Land Conservation Program Plan

Introduction and Overview

Coastal Ecosystems

Coastal ecosystems are diverse and productive. These valuable and irreplaceable assets are subjected to ever increasing pressures. Currently, the coast is ten times more densely populated than inland areas - a trend that will only continue to increase. Population growth leads to increasing threats to coastal ecosystems including loss of habitat and pollution. Because over 90% of coastal pollution is generated by land-based sources, the protection of coastal ecosystems involves land use decisions at the local, state, and federal levels. Protecting and restoring coastal ecosystems including wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, will require coordinated multi-disciplinary efforts involving all levels of government, the private sector, and the public. The Coastal Zone Management Plan (CZMP) plays an important role in shaping coastal ecosystem management policies, as well as improving, coordinating, and funding state and local activities in this arena.¹

Federal Guidance

The Department of Commerce, Justice, and State Appropriations Act of 2002 (Public Law 107-77), directed the Secretary of Commerce to establish a Coastal and Estuarine Land Conservation Program (CELCP) “for the purpose of protecting important coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from their natural or recreational state to other uses.” CELCP gives priority to lands that can be effectively managed and protected, provide public access to coastal and estuarine resources, and have significant ecological value.²

Definition of a CELCP Plan

A CELCP Plan is developed by each coastal state in order to participate in the program. It provides an assessment of priority land conservation needs and clear guidance for nominating and selecting land conservation projects within the state. Plans are intended to be fairly simple and concise, and may make use of work that has already been done in the state or region, such as regional, state, or local watershed protection, restoration or land conservation plans. A state may incorporate existing plans, or portions thereof, by reference into a CELCP Plan. State plans must be developed through a public process, which would include a public scoping process and a comment period. If a state CELCP Plan incorporates existing plans, or elements thereof that were developed and vetted through a public review process; the state may choose to seek comment on whether those plans or elements should be incorporated into the CELCP Plan, rather than seeking comment on the substance of those plans or elements.

Project Funding Process Overview

When grant funding is authorized at the federal level, the National Oceanic and Atmospheric Administration (NOAA) will notify states of a project submittal opportunity and timelines for applications. The State (Indiana Department of Natural Resources (DNR)) will then release a

¹ NOAA Coastal Management Draft 2007-2012 Strategic Plan

² Public Law 107-77

request for proposals (RFP) to eligible applicants (entities eligible for land acquisition grants). When proposals are received they will be reviewed and prioritized by the State using the established criteria in this plan. Top ranking projects will then be submitted to NOAA's Office of Ocean and Coastal Resource Management (OCRM) in Silver Spring, Maryland to compete in the national competitive process. Only those projects that compete well at the national level will receive funding, and ultimately the number of projects selected is also subject to the level of funding available. Funding will be provided by NOAA to the State for granting to the successful applicant(s). During the process, assurance of permanent land conservation will be required by the State.

Coastal and Estuarine Land Protection Priorities

Overview of Coastal and Estuarine Areas in Indiana

The physical features of Indiana's coastal region have been a major factor in the growth and development of coastal Indiana. Although the southern basin of Lake Michigan is predominantly urban and is one of Indiana's most populated and industrialized areas, many types of natural areas are still found in northwestern Indiana. The Indiana Dunes National Lakeshore is the third most biodiverse property in the National Park system on a per acre basis. This occurrence is unique because so many diverse types of natural areas are found in a relatively small geographic area. In fact, about 30% of the Indiana Lake Michigan region remains in its natural state. More than 32,000 acres of parks and nature preserves are owned by federal, state or local government to protect natural communities and provide recreational opportunities.

Approximately one third of the Indiana shoreline is industrial, one third of the shoreline is residential, and one-third of the shoreline is public property. A diversity of uses ranging from heavy industry to environmental preservation have all been accommodated in this relatively short and narrow corridor of land. Agriculture and fishing were important early commercial ventures. These land uses remain important in the region, but access to raw materials and ready transportation led to rapid industrialization. The development pattern generally applicable to the upper Great Lakes of commercial shipping also applied to northwest Indiana.

According to the Northwestern Indiana Regional Planning Commission report, "2030 Connections," the population is projected to increase by six percent by the year 2030. Under the current development pattern the amount of land developed to meet this need is not directly proportional to the percentage population growth and is noticeably higher than 6% due to urban sprawl development patterns. This residential growth is affecting some of the most critical natural areas and remaining habitats. The Indiana Lake Michigan Coastal Management Program (LMCP) is working with local governments to help protect and restore natural areas within and surrounding their communities.

The LMCP has responsibility to preserve, protect, and manage cultural and natural resources in the Lake Michigan watershed in Indiana. This watershed (HUC 04040001 Lake Michigan) is located in the far northwestern part of the State and encompasses a land area of 604 square miles within the northern halves of Lake and Porter Counties and the northern one-third of LaPorte County. It incorporates those areas that historically drained into the portion of Lake Michigan within the State of Indiana between the Illinois border and the LaPorte County line.

The Indiana CELCP Plan Goal

The State of Indiana has developed this CELCP Plan, in cooperation with federal, state and local government agencies, nongovernmental organizations, and interested citizens, in order to participate in the Federal Coastal and Estuarine Land Conservation Program. The CELCP Plan provides an opportunity to coordinate among stakeholders to plan for, and enact resource conservation in Indiana. The Indiana CELCP Plan provides an assessment of priority land conservation needs and guidance for nominating and selecting coastal and estuarine land conservation projects that are within CELCP priority areas within the State.

To meet federal guidelines, the Plan includes the following components: 1) The geographic extent of the coastal and estuarine areas that would be included in the Indiana CELCP Plan; 2) types of lands and values to be protected, and 3) potential threats of conversion. In addition, the Indiana CELCP also includes a state competitive process for selecting projects to submit to the Federal competitive process.

1) Geographic Extent of Indiana's Coastal Area

The CELCP boundary is the same as the regular program boundary for the LMCP. This area is generally based upon the historic 8 digit USGS Hydrologic Unit Code (see Fig, 1); but has been modified to following Township boundaries. It also includes approximately 241 square miles beneath Lake Michigan. The lakeward boundary is the jurisdictional border that Indiana shares with Illinois and Michigan. At its widest extent, the boundary extends away from the shoreline 17 miles to the Crown Point area and at its narrowest point, less than 2 miles, just north of Hudson Lake in LaPorte County. The boundary follows the 45-mile Lake Michigan shoreline and approximately 52 miles from the Illinois border to the easternmost edge of the watershed along an east-west trajectory.

2) Types of Lands and/or Values to Be Protected in the Indiana CELCP

The CELCP authorizing language states the intent to protect lands “that are threatened by conversion from their natural or recreational state to other uses.” The intent of the Indiana CELCP Plan is to develop a large scale framework map that provides guidance for natural resource protection at the regional level while providing source information to communities to use at the local level for their planning needs.

Project Areas - Indiana's Priority Areas

The Indiana CELCP Plan is based upon the Indiana Biodiversity Initiative (IBI) model which identifies areas using Heritage plant occurrence data and umbrella animal habitat information as determined by the, “Biodiversity Conservation Possibilities and Threat Assessment of for the Indiana Lake Michigan Coastal Management Program: an update and analysis of part of the Northwest Morainal Natural Region assessment of the Indiana Biodiversity Initiative”³

³ Prepared by the Indiana University School of Public and Environmental Affairs and US Fish and Wildlife Service Bloomington Field Office, working through the Indiana Biodiversity Initiative (IBI). **Meretsky et al., March 1, 2006**

Lake Michigan Coastal Program Area

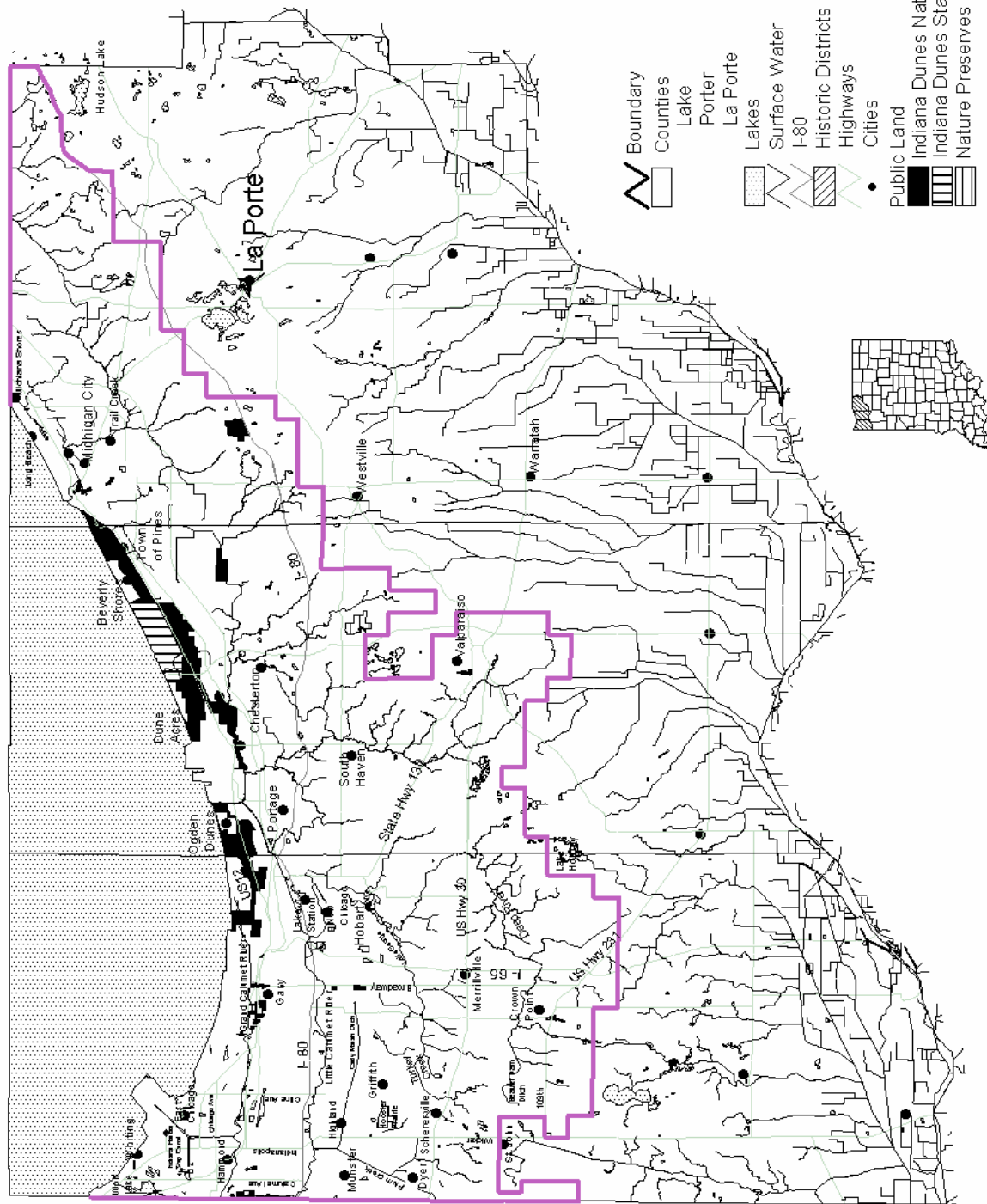


Figure 1: The Indiana CELCP boundary.

For the purposes of the CELCP, “Project Areas” describe Indiana’s priority areas for conservation representing state preservation values and areas threatened by conversion. These areas represent a cross section of historical and existing ecosystems native to the Indiana Coastal Region. It is the intent of the LMCP CELCP to preserve these ecologically sensitive areas. The Public Technical Workgroup (PTW) identified these areas to be protected through the CELCP. The IBI project identified and graphically depicts important ecological areas within the Indiana Coastal Region (see graphic on Page 11) and these areas are eligible for CELCP funding. The PTW also developed a list of state criteria review to ensure the projects selected return the best investment in resource protection possible.

Indiana Biodiversity Initiative (IBI)

The IBI is a group of researchers and agency and academic natural resource and conservation biology managers who work together to develop a common basis for conservation land-use planning in Indiana. The IBI uses a sequence of mapping exercises to identify areas that offer strong potential to conserve the greatest biodiversity for the natural regions of Indiana (Homoya et al. 1985). The IBI process is comprised of two distinct phases that take into account I: historical plant occurrences and II: umbrella animal species potential habitat.

(See **Appendix A** for additional background information on the IBI)

Phase I: Habitat areas with the highest concentration of desirable characteristics: Plant species and high-quality plant community data are identified using GIS software to identify numbers of rare species, availability of high-quality habitats, or large blocks of more common habitats information from the Indiana Heritage Database, the GAP map of general land cover of Indiana, the National Wetlands Inventory (NWI) of wetlands of Indiana, and the map of existing areas protected for conservation (primarily public lands, with some additional lands such as Nature Conservancy holdings). The software generates a spatially optimized solution to preserve the highest biodiversity of plant species within a defined area.

Phase II: Lands that protect animal species: Using the data gathered from Phase I, the IBI had a starting point for identifying lands that protect animal species. The IBI chose to identify umbrella species whose habitat needs encompass the habitat needs of many other species. For the Indiana CELCP Plan, 8 species are selected and their habitat needs are modeled. (See **Appendix A** for specific IBI figures – species occurrence, tables of LULC acres, etc.). These umbrella species were selected because of their representative habitat requirements.

The IBI and PTW also made suggestions for the connection of blocks of habitat. The PTW included power line, gas line, and riparian corridors as part of the preferred habitat map (see Figure 3). The inclusion of these features is one of the scoring criteria for the state competitive process. In addition, a “conservation features” layer from the IBI permits users to click on any particular cell and learn what animal species models select that cell, how much area is available in several habitat types within the cell, and how many rare plants or high-quality plant communities have been identified in the square.

Features of the Northwest Morainal Natural Region

The Lake Michigan watershed is a portion of the Northwest Morainal Natural Region, the smallest of Indiana’s natural regions, but one of the most diverse. The basis for the IBI study area is a map of

the Northwest Morainal region using a kilometer grid that matches the UTM grid. The Northwest Morainal Region's northern position brings in elements of the boreal forest, including bogs; its eastern position gives it prairies, ranging from sand to mesic prairies; its position at the shore of Lake Michigan brings dune and swale topography and the march of successional habitats from ephemeral dune plants to mesic forest. Portions of the Valparaiso Moraine that mark the southern portion of natural region was once marked by extensive oak savanna, now often changed to forest by fire suppression. Other habitat types comprising the Moraine are reported to include beech-maple forests as well as additional species.

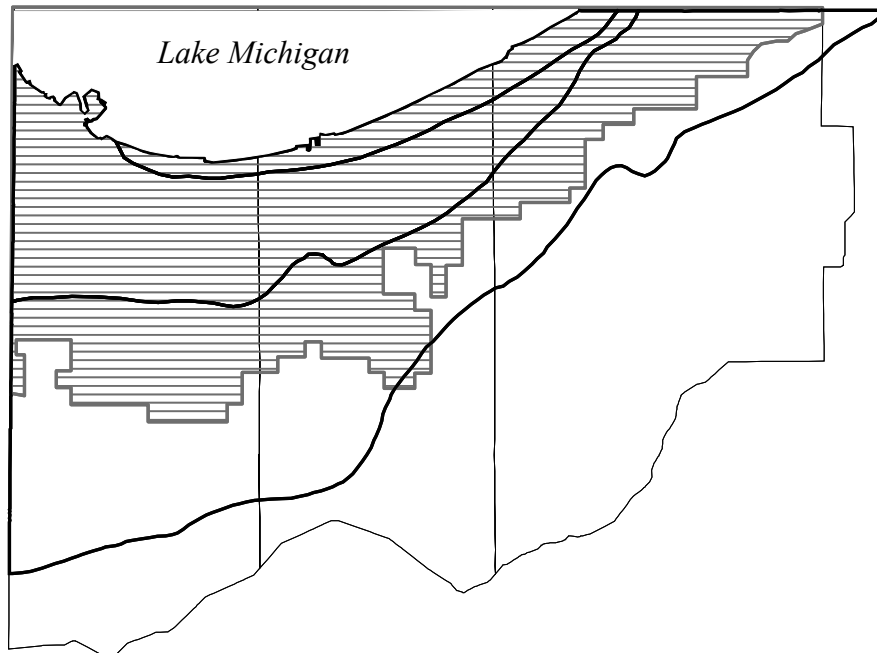


Figure 2. The LMCP terrestrial area (grey outline and horizontal hatching) with Lake, LaPorte, and Porter counties (thin black lines). The Northwest Morainal Natural Region and its 3 sub regions are shown in heavy black lines

Coastal Areas of Significance

CELCP projects that fall within the priority map automatically address the Coastal Areas of Significance requirement identified by the LMCP. It is important to note that the APC categories guide the regular Section 306A Acquisition and Low Cost construction grants. Whereas all CELCP projects meet the APC requirement not all APC items meet CECLP requirements. (See **Appendix B** for more detailed information on Coastal Areas of Significance from the Program document.)

Areas of Particular Concern (APCs)

The LMCP document outlines the process of APC designation to identify existing initiatives and partnership opportunities. The creation of APC prioritizes the allocation funds for the LMCP and coastal grants program, promotes interagency cooperation, provides technical assistance, and supports research and local planning. It is the intent of the LMCP that APC status serve as an important tool for state agencies, local governments, and organizations facing complex and pressing natural resource management issues. APC are broad groups of coastal areas facing similar issues for which priorities can be defined. The process allows for site specific APCs to be nominated

annually. It is the intent of the LMCP that the CELCP priority area map, and associated data, serves as a basis for nominating and evaluating site specific APCs. Federally owned or leased lands cannot be designated as APC due to the restriction that prevents the use of LMCP funds on federal lands.

Categories of APCs:

1. Areas of unique, scarce, fragile or vulnerable natural habitats
2. Areas of historical significance, cultural value, or substantial recreational value or opportunity
3. Areas of high natural productivity or essential habitat for living resources, including fish, wildlife, endangered species, and the various trophic levels in the food web critical to their well-being
4. Areas needed to protect, maintain, or replenish coastal lands or resources including coastal flood plains, aquifers and their recharge areas, sand dunes, and offshore sand deposits
5. Areas where development and facilities are dependent upon the use of or access to coastal waters or areas of unique features for industrial or commercial uses or dredge spoil disposal (not eligible under CELCP)
6. Areas where if development were permitted, it might be subject to significant hazard due to storm, slides, floods, erosion, and settlement

3) Potential Threats of Conversion

The LMCP CELCP includes a threat conversion data layer. The threat conversion data layer uses available data on 1) Roadway development projects, and 2) Projected urban growth patterns (See Figure 4).

The IBI consulted the Northwestern Indiana Regional Planning Commission (NIRPC) report “2030 Connections” to understand the likely pattern of development in the region. Development was determined by the IBI to be the principal threat to habitat in the CELCP boundary. Among the forecasts included in the report are maps of population change from 2000 to 2030, the 2030 anticipated growth areas, and the committed and 2030 proposed road network expansions. The proposed projects particularly intersect potential conservation area in the northwest of the LMCP area and along the west edge of LaPorte County. The three counties within the LMCP boundary currently have very different population densities and change trajectories:

Lake County is heavily urbanized and had 975 persons per square mile, according to the 2000 census. Over the periods 1990-2000 and 2000-2003, population change in Lake Co. lagged considerably behind state averages (1.9% vs. 9.7%, and 0.6% vs. 1.9%).

Porter County, with 351.1 persons/square mile in 2000, grew faster than the state average over 1990-2000 and 2000-2003 (13.9 % vs. 9.7%, and 3.9% vs. 1.9%).

LaPorte County, with 184.1 persons/square mile in 2003, increased slowest of the 3 counties in 1990-2000 (2.8% vs. 9.7% in Indiana overall) and lost population during 2000-2003 (-0.2 persons/square mile). The least urbanized area with high-conservation-value.

The data provide an estimate of the areas most at risk of short term conversion and as such receive extra consideration in the Indiana CELCP state competitive process. (Figures 6-8 within **Appendix A** of this document depict those areas at risk of conversion.)

State Process for Implementing the CELCP

State Lead Agency

The DNR has been designated as the lead state agency responsible for implementing the Indiana CELCP Plan. The DNR, Division of Nature Preserves, is the agency responsible for implementing the LMCP approved pursuant to the federal Coastal Zone Management Act (CZMA) of 1972, as amended.

Agencies Eligible to Hold Title to Property

NOAA may make financial assistance awards to designated recipients in eligible coastal states. As the designated CELCP lead agency, DNR may in turn allocate grants or make sub-awards to other state agencies, local governments as defined at 15 CFR 24.3, or entities eligible for assistance under section 306A(e) of the CZMA (16 USCA § 1455a(e)) to carry out approved projects. Local governments are defined by 15 CFR 24.3 as a county, municipality, city, town, township, local public authority (including any public and Indian housing agency under the U.S. Housing Act of 1937), school district, special district, intrastate district, council of governments (whether or not incorporated as a nonprofit corporation under state law), any other regional or interstate government entity, or any agency or instrumentality of a local government. Section 306A (e) of the CZMA (16 USCA § 1455a (e)) includes area-wide agencies designated under section 204 of the Demonstration Cities and Metropolitan Development Act of 1966 (42 USCA § 3334), regional agencies, or interstate agencies.

The LMCP conducts an annual coastal grants program and has developed a list of eligible recipients for this funding. The entities eligible for land acquisition grants are also eligible for CELCP funding. However, the following entities would only be eligible for CELCP acquisition funds if the goal of the project was long term habitat protection and a management plan developed accordingly. Funds are not eligible for other uses. Eligible entities include:

- Units of local government, such as municipalities, townships, counties, cities, and towns
- Area-wide agencies, including county and regional planning agencies
- State agencies
- State colleges, universities, and other state institutions of higher learning
- Conservancy districts and port authorities
- Basin commissions

State Competitive Nomination Process

The process of CELCP project nomination and selection included in the Indiana CELCP Plan contains the following elements:

Public Forum: In conjunction with the coastal grants program, the LMCP will announce in a public forum the intent to meet to discuss Annual priority setting for CELCP. This process is similar to the existing Coastal Grants Public Forum process and will be held in conjunction with that process in July of each year. The LMCP will use public and Coastal Advisory Board input to set the CELCP priorities for each year. These priorities can include habitat type, geographic area, and or species occurrence.

Solicitation of Project Proposals: Upon notification from NOAA of the availability of CELCP funding, the Indiana DNR will notify and solicit project proposals from partners in the CELCP boundary.

Project Proposals: Project proposals will be solicited from eligible partners in the LMCP boundary and notification will be made of the process and deadline for submission. Only eligible entities may nominate projects and must have already reached agreement with a willing landowner.

State Review and Prioritization:

1. Proposal acceptance - Completed applications will undergo initial review by LMCP staff to determine whether a proposal is complete and eligible under the criteria identified in Section II of the CELCP Final Guidelines. If the application is incomplete, the LMCP may provide an opportunity for applicants to submit any information that is missing.
2. Proposal review and ranking - Proposals accepted for consideration will be reviewed by a committee designated by DNR. The committee, at a minimum, will consist of a representative from the following:
 - DNR Division of Fish and Wildlife
 - DNR Division of Outdoor Recreation, Land and Water Conservation Fund Program, and Recreational Trails Program
 - DNR Division of State Parks and Reservoirs
 - DNR Division of Fish and Wildlife, Lake and River Enhancement Program
 - DNR Division of Nature Preserves
 - DNR Division of Forestry
 - Indiana Heritage Trust Program

State Review Criteria:

The following list of state criteria are intended to ensure the projects selected return the best investment in resource protection possible. The CELCP project must meet at least one of the following conditions (meeting all associated sub criteria) and occur within the area identified as CELCP Priority Areas on Page 11:

- Expand existing managed areas
 - a. Property must be adjacent to an existing managed area with public interest
 - b. Property must be managed for similar passive recreation use/resource protection
 - c. Must be high quality habitat
- Create connectivity/buffer existing natural areas
 - a. Property must be adjacent to existing managed area
 - b. Property must be managed for similar passive recreation use
- Priority category that include 200 ft buffer along Lake Michigan
 - a. In keeping with Marquette principles (a comprehensive plan for securing public, green space along the northwest Indiana lakefront)
 - b. Property must be managed for resource protection/public access
- Migratory Bird Habitat
 - a. Must be identified as such by the Audubon/Bird Conservation Alliance and
 - b. Managed for resource protection/passive recreational use only
- Identified in Statewide Comprehensive Outdoor Recreation Plan (SCORP) as:

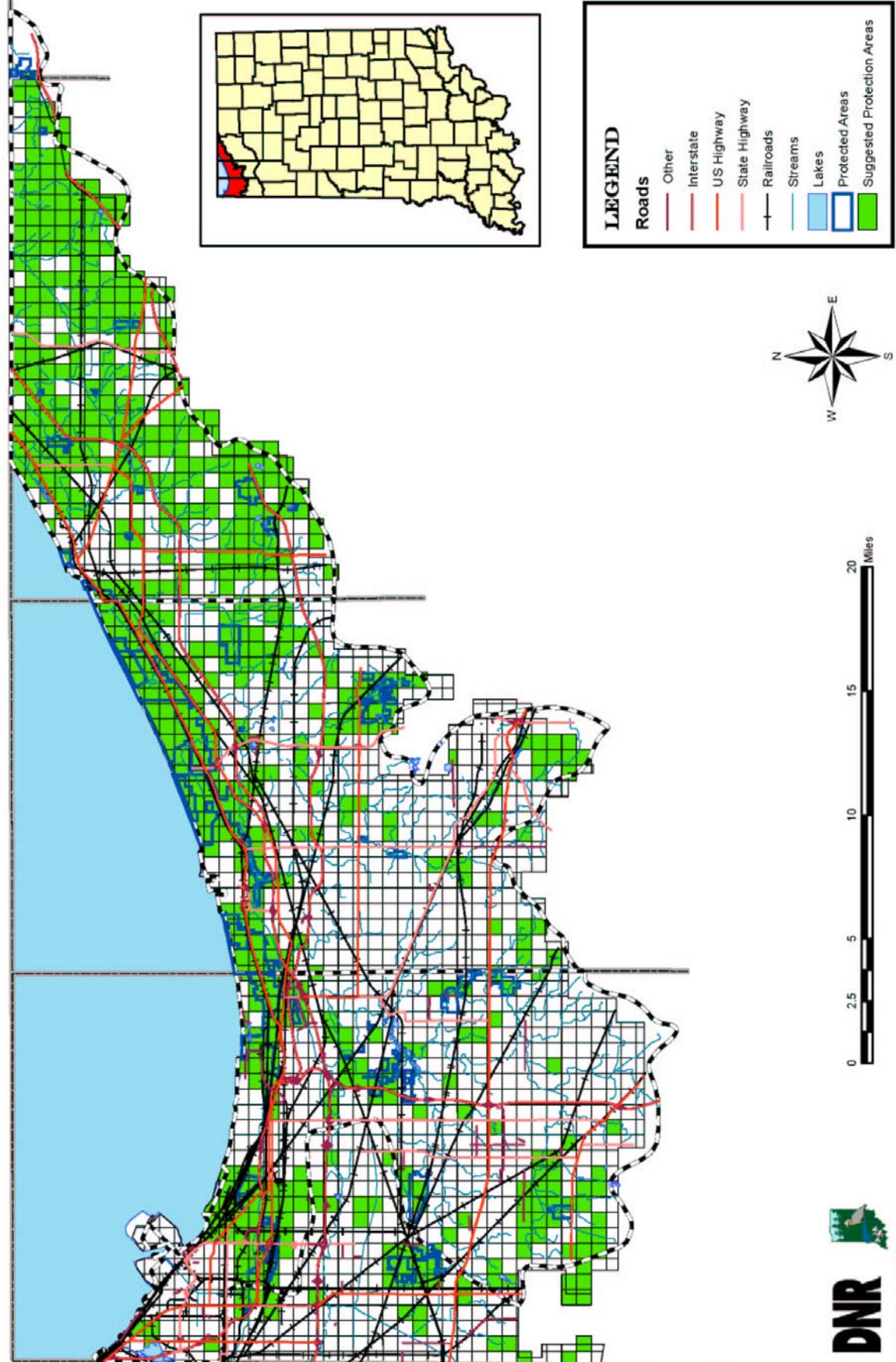
- a. providing increased public access
 - b. providing new passive recreation; and
 - c. include resource management plan
- Included in Inventory of Cultural and Historic Resources
 - a. Property must be listed in LMCP Inventory of Cultural and Historic Resources
 - b. Property must have significant tie to coastal culture and history
- Area identified in IBI project as high threat of conversion (Bonus Criteria)
 - a. IBI for the coastal region identified areas at risk of conversion from natural state. Project must protect property from conversion that degrades natural resource values.
 - b. Project must provide long term protection from conversion.

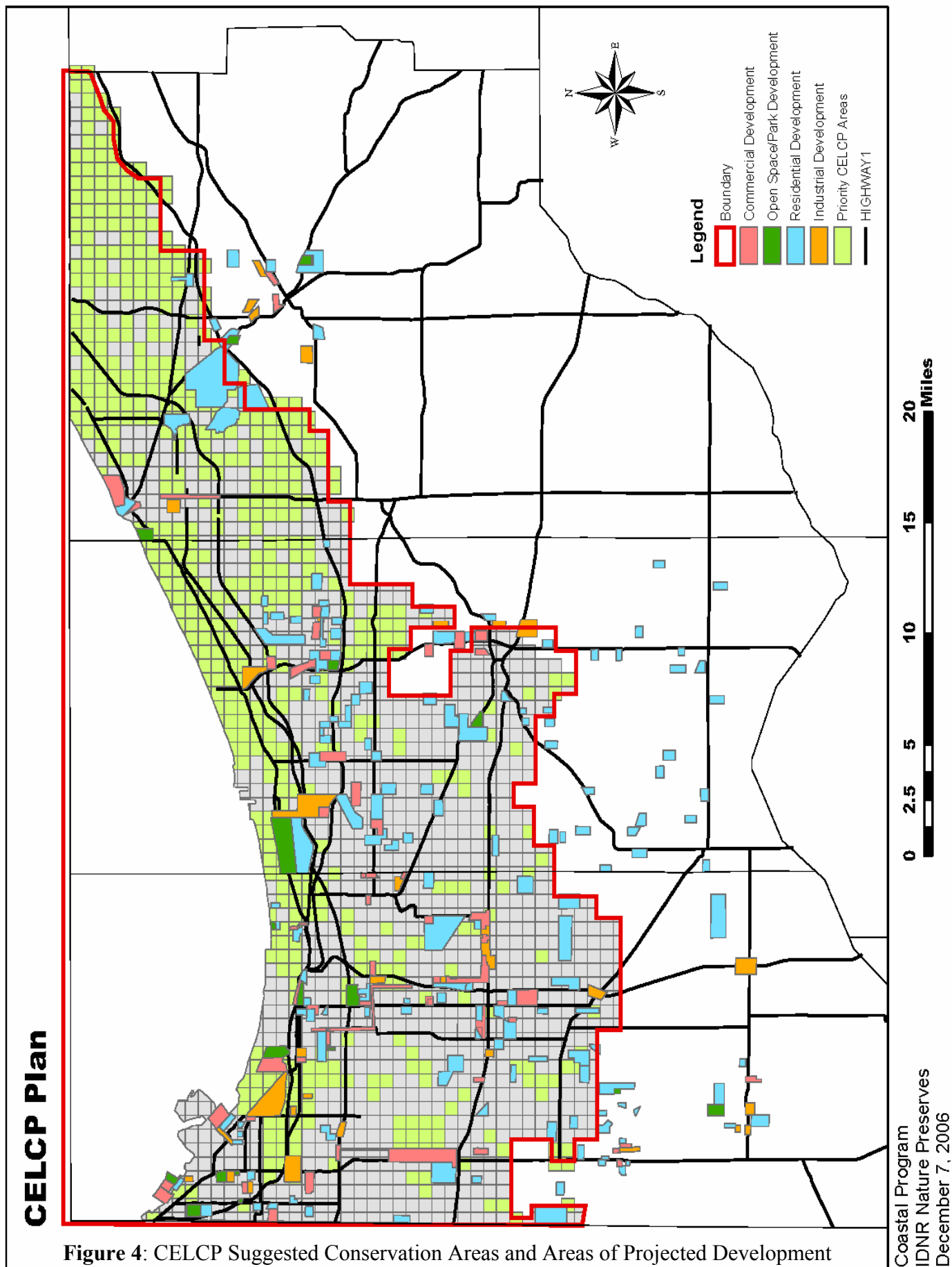
Existing Plans Incorporated into the Indiana CELCP Plan

The Indiana DNR aimed to create a comprehensive land acquisition plan and the resulting CELCP serves as a framework of goals and policies to assure efficient stewardship of the State's cultural and natural resources. This plan incorporates all the existing plans prepared for land acquisition, and also new planning and implementation efforts. The ultimate success of the Indiana CELCP relies on active public participation. This is a dynamic opportunity to address the important role of land acquisition in managing Indiana's coastal resources. (See **Appendix C** for information on the location of the following plans.)

- Marquette Plan Phase I and II, a comprehensive plan for securing green and public space along the northwest Indiana lakefront.
- The Indiana Dunes National Lakeshore Migratory Bird Habitat
- *Statewide Comprehensive Outdoor Recreation Plan 2000-2004* (SCORP)
- *The Coastal Historic and Cultural Resources Study of the Lake Michigan Watershed*
- IBI project for the coastal region, data identifying areas at risk of conversion from natural state.
- Northwestern Indiana Regional Planning Commission's *Greenway and Blueway Plan*

Figure 3: CELCP Priority Areas and Linear Corridors





Coordination and Public Involvement

Two Phase Development Process

Indiana's CELCP Plan was developed using a two phase process:

Phase I : Using the Indiana University in the IBI project, data layers were identified and included in the IBI model to develop CELCP Priority Areas; and

Phase II: The Public Technical Workgroup (PTW) was formed to identify gaps in existing data and to coordinate with other state agencies to develop a State CELCP Plan. In addition, the PTW developed the state project criteria and project nomination process.

A CELCP Web page was developed on the DNR – LMCP website to provide information to stakeholders and the public including NOAA guidance and project applications (<http://www.in.gov/dnr/lakemich/grants/CELCP.html>).

Interagency Coordination

The LMCP invited all interested state, local, and federal agencies to participate in the PTW including:

- Indiana Dunes National Lakeshore
- US Fish and Wildlife Service
- DNR
 - Division of Fish and Wildlife
 - Division of Water
 - Division of Nature Preserves
- Indiana Department of Environmental Management (IDEM)
- Northwestern Indiana Regional Planning Commission (NIRPC)
- Illinois-Indiana Sea Grant
- City and County Park Departments
- City and County Planning Departments

Five meetings were held with agency partners to gather input for the CELCP Plan including:

- Presentation of the CELCP to LMCP Coastal Advisory Board (CAB) and public attendees
- Presentation of CELCP planning and development to Northwestern Indiana Regional Planning Commission (NIRPC) Environmental Management Policy Committee
- Coordination meeting with Alliance for the Great Lakes, Chicago Wilderness, NIRPC, and Save the Dunes Council
- Coordination meeting with (IDEM) staff
- Coordination meeting with DNR staff

Public Involvement

In order to participate in the CELCP, the LMCP as the lead state agency is responsible for developing a CELCP Plan. The plan is to include an assessment of priority land conservation needs and clear guidance for nominating and selecting land conservation projects within the state.

The Plan was written with the assistance of the PTW which is comprised of the Program's many conservation partners. (See **Appendix D** for a list of PTW members and meeting participants.) The first formal presentation of information regarding the IBI output took place at the October 12, 2005 CAB meeting.

The LMCP convened five PTW meetings. These occurred on the following dates:

Meeting 1 – December 8, 2005 – NIRPC

Meeting 2 – January 5, 2006 – NIRPC

Meeting 3 – March 29, 2006 – Indiana Dunes State Park Nature Center Auditorium

Meeting 4 – April 20, 2006 – Indiana Dunes State Park Nature Center Auditorium

Meeting 5 – March 15, 2007 – Indiana Dunes State Park Nature Center Auditorium

Meeting 1:

The first PTW meeting agenda included a presentation by Dr. Vicky Meretsky, a discussion, and overview of the CELCP process followed by a workgroup session. Discussion focused on work to date and the steps that would be required to incorporate the IBI data into an acceptable format. Members of the PTW provided comments and suggestions regarding additional data to include as a supplement to the existing IBI data. Suggestions included stream, multi-use trail, and power line corridors to connect fragmented habitat. In addition, members of the PTW provided some information regarding additional managed areas and additional areas of ecological importance to include in CELP Priority Areas.

Meeting 2 – Process:

The second PTW meeting focused on the process of developing a project solicitation and nomination process. The LMCP staff facilitated small groups to develop a list of factors to include in this process. Staff compiled this information and developed a nomination process for PTW review and comment.

Meeting 3 - Filling Information Gaps:

The third PTW meeting focused on filling information gaps in CELCP Priority Areas. The LMCP in coordination with Dr. Meretsky updated the IBI maps to include data layers suggested during the first PTW meeting. The LMCP staff discussed the data changes and solicited feedback from PTW members regarding the inclusiveness of managed areas and ecologically sensitive areas on the IBI maps for the CELCP Priority Areas.

Meeting 4-State Nomination and Evaluation Process:

The fourth PTW meeting addressed state nomination and evaluation process. The LMCP staff developed (from results of PTW 2) a list of state criteria and project nomination format. The PTW reviewed and provided input on the proposed CELCP project application and associated guidance document. In addition, the PTW reviewed and provided input to the list of state nomination and review criteria.

Meeting 5 – Draft Plan Unveiling:

The fifth and final meeting was the start of the 30 day public comment period. At this meeting LMCP staff presented the final draft CELCP plan and answered questions from the public. This meeting was held in conjunction with the IDEM Area of Concern meeting.

Public Technical Workgroup (PTW) Outcome

In the full public development process of the Indiana CELCP Plan, the LMCP and its partners completed the following steps to determine Indiana's priorities for conservation through CELCP:

- incorporated additional data layers into the CELCP Priority Area identification;
- created a planning map depicting CELCP Priority Areas
- developed the project nomination process; and,
- provided input into the draft CELCP Plan for the State of Indiana.

Certification and Approval**Certification of Consistency**

The certification of consistency plan was prepared by the lead state agency responsible for administering the federal consistency provision of the Coastal Zone Management Act, and is consistent with the enforceable policies of the state's federally approved coastal zone management program.

Plan Approval

Approved this 29th day of January, 2008 by:

Mike Molnar
Indiana's Lake Michigan Coastal Program
Program Manager

APPENDIX A: Indiana Biodiversity Initiative Report

Terrestrial biodiversity and threats assessment

Introduction

The Indiana Lake Michigan Coastal Program area of responsibility. The Indiana Lake Michigan Coastal Management Program (LMCP) has responsibility to support cultural and natural resources in the Lake Michigan watershed in Indiana, which is entirely within Lake, Porter, and LaPorte counties (Table 1).

County	Area in hectares	Area in acres	% of total coastal area
Lake	69,439	171,583	44
Porter	52,396	129,470	33
LaPorte	35,870	88,635	23
Total	157,704.5	389,688	100.0

Table 1. Study area by county.

The Northwest Morainal Natural Region. The Lake Michigan watershed is a portion of the Northwest Morainal Natural Region, the smallest of Indiana's natural regions, but one of the most diverse (Fig. 1). Its northern position brings in elements of the boreal forest, including bogs; its eastern position gives it prairies, ranging from sand to mesic prairies; its position at the shore of Lake Michigan brings dune and swale topography and the march of successional habitats from ephemeral dune plants to mesic forest. The Valparaiso Moraine that marks the southern portion of natural region was once marked by extensive oak savanna, now often changed to forest by fire suppression.

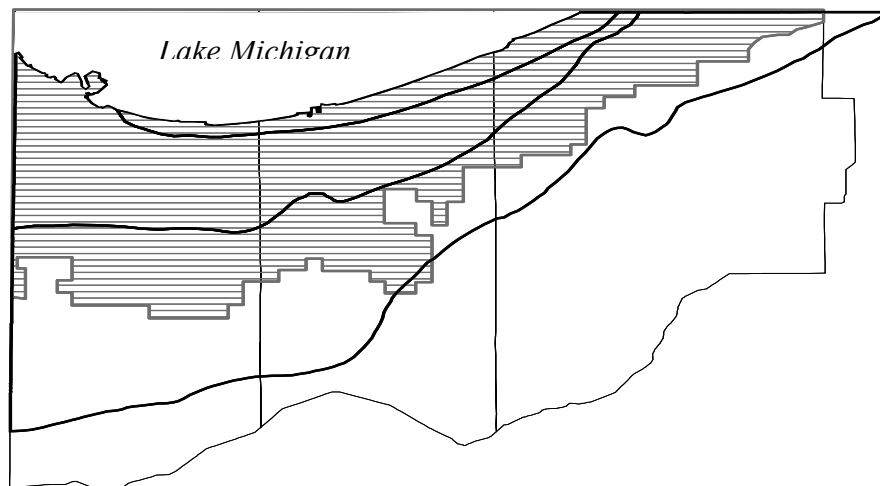


Figure 1. The Indiana Lake Michigan Coastal Program terrestrial area (grey outline and horizontal hatching) with Lake, LaPorte, and Porter counties (thin black lines). The Northwest Morainal Natural Region and its 3 subregions are shown in heavy black lines

Indiana Biodiversity Initiative goals, methods, and products. The Indiana Biodiversity Initiative is a group of agency, organization, and academic natural resource and conservation biology managers and researchers working together to develop a common basis for conservation land-use planning in Indiana. We use a sequence of mapping exercises to identify areas that offer strong potential to conserve biodiversity. We develop maps of areas with high potential for biodiversity conservation for the natural regions of Indiana (Homoya et al. 1985). Our map base is a kilometer grid that matches the UTM grid.

We begin with the plant species and high-quality plant community information from the Indiana Heritage Database, the GAP map of general land cover of Indiana, the National Wetlands Inventory (NWI) of wetlands of Indiana, and the map of existing areas protected for conservation (primarily public lands, with some additional lands such as Nature Conservancy holdings). We use these three maps in Phase I to identify the plant-related features for conservation and we use C-Plan, a spatial-optimizing program that identifies land areas that fulfill a conservation objective using the smallest footprint. Because of this spatial optimizing, C-Plan identifies those areas with the highest concentration of desirable characteristics – numbers of rare species, availability of high-quality habitats, or large blocks of more common habitats.

After the areas with high plant conservation potential have been identified, we use those and the map of existing areas protected for conservation as a starting point for identifying lands that protect animal species, in Phase II. Because we lack the time and information to identify lands that meet needs of all animal species in a given natural region, we identify umbrella species (Lambeck 1997) whose habitat needs encompass the habitat needs of many other species. For each natural region, 6-9 species are selected and their habitat needs are modeled (Appendix 2). Then, using a supplement to the ArcView GIS program, we identify areas that meet the habitat needs of the umbrella species while avoiding habitats that would be hostile to them (often, urban habitats, for example). The animal modeling program gives preference to areas that are already protected, or that were identified for plant conservation, when these are appropriate, so as to continue to minimize the extent of the land areas identified and to cluster habitat blocks.

The final product for any given natural region is a map identifying those square kilometer blocks that have best met the plant and animal conservation criteria of the two phases of the select process. We also suggest possible corridors, often river corridors, but also ridgelines and even powerlines, which may serve to connect blocks of habitat. We provide users with the map as well as with a wide range of auxiliary maps, the color orthophotos, and the appropriate USGS 1:100,000 maps. A “conservation features” layer permits users to click on any particular cell and learn what animal species models select that cell, how much area is available in several habitat types within the cell, and how many rare plants or high-quality plant communities have been identified in the square.

We stress that our product maps are only advisory and must be updated by local users familiar with their own planning needs (as is being done in this contract). Our maps were created with databases that are constantly being made obsolete by new development and by other changes in land use. In addition, they were developed using only our criteria for biodiversity conservation; different, or more tightly focused, criteria would target other areas.

The current project

The current project is an update of that portion of the Northwest Morainal natural region assessment within the LMCP boundary using 2003 aerial orthophotographs and on-the-ground verification where necessary. The original land-cover classification used for the natural region assessments is the Indiana GAP map, which dates to 1992. Additional wetlands information was taken from the NWI for Indiana was completed by the early 1980s. Finally, rare species and high-quality community data came from the Indiana Heritage database, which is continuously added to, but not regularly checked to confirm continued existence of observed species or communities. The project provides the LMCP with an updated understanding of those areas originally identified as being of potentially high conservation value. In addition, a threats assessment was conducted to indicated which areas identified in the original assessment, and unaffected by change, are most at risk of future modification that may affect their conservation value.

The original assessment

Thirty-seven percent of the area in the Lake Michigan watershed was identified as having high potential conservation value during the original Northwest Morainal natural region assessment (Table 2, Figure 2). Thirty percent of the identified area was selected only by the Phase I vegetation conservation process, 42% was selected only by the animal habitat conservation process, and 28% was selected by both processes. The selected areas increased from west to east, with 26.5% of the selected area in Lake Co., 30% in Porter Co., and 43.5% in LaPorte Co.

Eight animal species were selected as umbrella species to represent habitat needs for the Northwest Morainal natural region (Appendix 2). The American badger (*Taxidea taxus*; state endangered) is a grassland mammal that represents grassland species generally, and the specific needs of burrowing mammals. The blue-spotted salamander (*Ambystoma laterale*; state species of special concern) and Blanding's turtle (*Emydoidea blandingii*; state endangered) both need aquatic habitat, but the salamander uses vernal pools and other ephemeral wet habitats, whereas Blanding's turtles need year-round water; both species need adjacent upland habitats as do many

	Area in hectares	Area in acres	% of total area
All cells selected in Phase I	34,039.8	84,112.4	21.6
Cells selected only in Phase I	17,590.4	43,465.8	11.2
All cells selected in Phase II	40,767.6	100,736.8	25.9
Cells selected only in Phase I	24,318.2	60,090.2	15.4
Cells selected in both Phase I & II	16,449.5	40,646.6	10.4
Total Phase I and Phase II cells	58,358.0	144,202.6	37.0

Table 2. Northwest Morainal natural region assessment results within the Lake Michigan Coastal Management Program boundary. Cells in the map might be selected during vegetation selection (Phase I) or during animal habitat selection (Phase II) or during both. Interior cells were 1 square kilometer, but cells along the boundary might be any size up to 1 square kilometer.

other aquatic and semi-aquatic vertebrates. Scarlet tanagers (*Piranga olivacea*) and red-shouldered hawks (*Buteo lineatus*; state species of special concern) are forest birds; red-shouldered hawk habitat typically includes some bottomland forest near water. Golden-winged warblers *Vermivora chrysoptera*; state endangered) represent species using shrubby habitats. The Karner blue butterfly (*Lycaeides melissa samuelis*; Federal endangered) uses networks of small areas of open habitats. For this species, we borrowed a model created by The Nature Conservancy and used it without alteration as it relied on expert information not otherwise readily available. Eastern massasaugas (*Sistrurus catenatus*; Federal candidate species) use a mosaic of upland and wetland habitats that offer protective cover. The area needs of red-shouldered hawks and scarlet tanagers ensured that blocks of forests would be selected, and the badger served a similar purpose for grasslands.

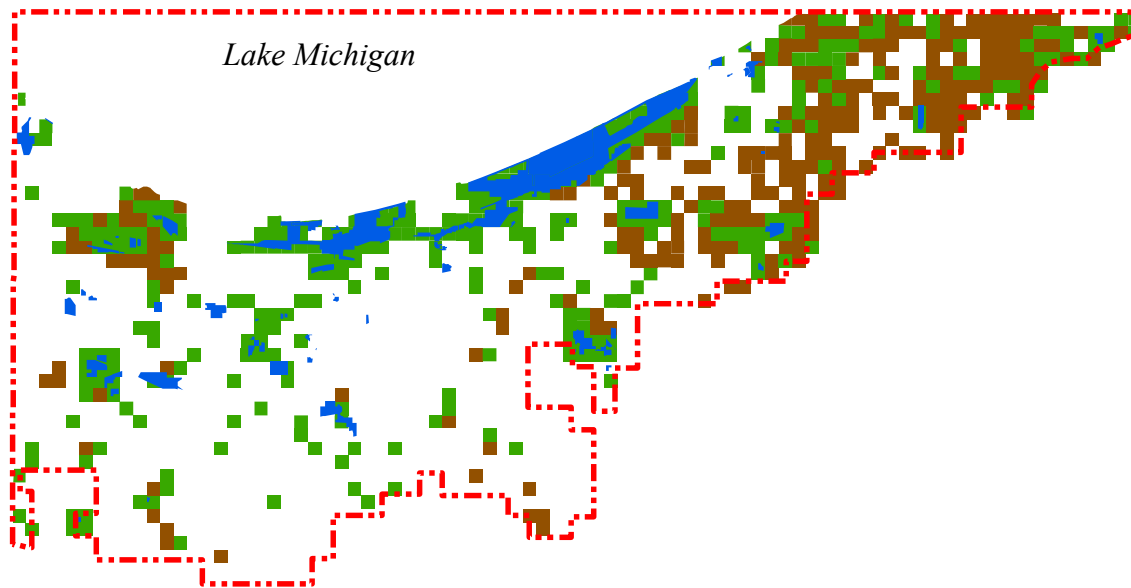


Figure 2. Areas selected during the original Northwest Morainal natural region assessment that fell within the LMCP boundary. Existing managed areas (parks, preserves, etc.) are shown in blue; additional areas added during Phase I are green, and additional areas added during Phase II are shown in brown (some cells were selected during both phases).

Updating the Conservation Maps within the LMCP boundary

Assessment from color orthophotos. We updated the classification of habitats in the Phase I and Phase II output cells using 1-m-resolution color orthophotos flown in 2003 and the Advanced Identification (ADID) wetland survey conducted in 1996-2002. The GAP maps, Heritage records, and NWI classifications used for the original work were compared to these more recent layers, and changes were made as appropriate. For Phase II squares, in which the choice of cell was sometimes affected not only by habitat in the square, but also by habitat in a buffer area surrounding the square, we also updated information in the buffer (buffer distances ranged from 100-500 m for species for which buffers were used – see Appendix 2).

Ground verification. When inspection of the orthophoto was not sufficient to confirm or clearly correct the original classifications, we visited the sites and identified the present ground cover. We also used ground verification when the 2003 image showed recent development or when we considered it possible that more development might have occurred in the intervening 2 years.

Obviously, in instances where new development has only begun since the 2003 image, we had no way of detecting such development. Thus, the classification of habitat in the potential-high-conservation-value cells can only be considered updated to 2003, but it will sometimes be accurate to summer 2005.

When updating the NWI classifications, we generally did not try to identify hydroperiod of any changed classifications that might include a hydroperiod classifier. For example, if an emergent wetland originally classified as PEMC (C is a hydroperiod classifier) had become a deciduous-forested wetland, we typically classified the new wetland as PF01, not PF01C.

Areas updated. A total of 194 of 607 cells (32%) were updated or corrected as a result of aerial photo inspection of ground truthing. Changes were as simple as changing a polygon labeled “row crop” to one labeled “pasture/grassland” or as involved as redigitizing boundaries and relabeling several polygons in the cell. In some instances it was easy to differentiate a correction from an update (an old, heavily wooded suburban area originally identified as forest needed correction; a new, sparsely vegetated suburban area originally identified as forest needed updating). Other changes, however, were less clear, particularly those involving row crops and pasture in areas that switch from one to the other; identifications involving short-hydroperiod wetlands and pastures were similarly difficult as well, owing to the very dry summer preceding the ground check. We only indicated a correction when we were quite certain the modification was the result of an error in the original classification; thus the type of modification (update or correction) is biased toward “update.”

Redigitizing. Corrections and updates made during inspection of color orthophotos or during ground verification were incorporated into updated GAP, NWI or Heritage databases as appropriate. GAP and NWI layers were then rebuilt to reestablish topology, and polygon sizes were checked to ensure that no slivers (small unclassified polygons) were introduced during the redigitization. GAP changes were made in 159 cells (141 updates, 8 corrections, and 10 cells with both), NWI changes in 43 cells (41 updates, 2 cells with updates and corrections), and the 2 changes were made in the Heritage database (one species occurrence and one high-quality habitat occurrence eliminated, in separate cells). Figure 3 shows the location of cells where changes were made as a result of ground- or air-photo-based inspection. The accompanying GIS allows users to investigate specific changes in individual cells.

Update for urban/suburban land cover. We limited intensive scrutiny of the original habitat layers to the cells and buffers that were composed the recommended conservation areas from the original IBI process. However, during this process we realized that the extent of urban and suburban expansion was likely to affect any new IBI-style assessment of the region. Because of the impact of urban/industrial and suburban development on habitat, we attempted to update these cover types over the entire LMCP area of interest, from the 2003 color orthophotos (Figure 4). Some older neighborhoods with heavy tree cover may have been missed, as these can be difficult to detect from aerial photos, however we are confident that we detected the large majority. The added urban areas are predominantly in the southern part of the LMCP area, and predominantly in Lake and Porter Counties. However, the “salt and pepper” effect of newly developed areas in LaPorte Co. indicates that habitat loss is becoming an issue there, as well.

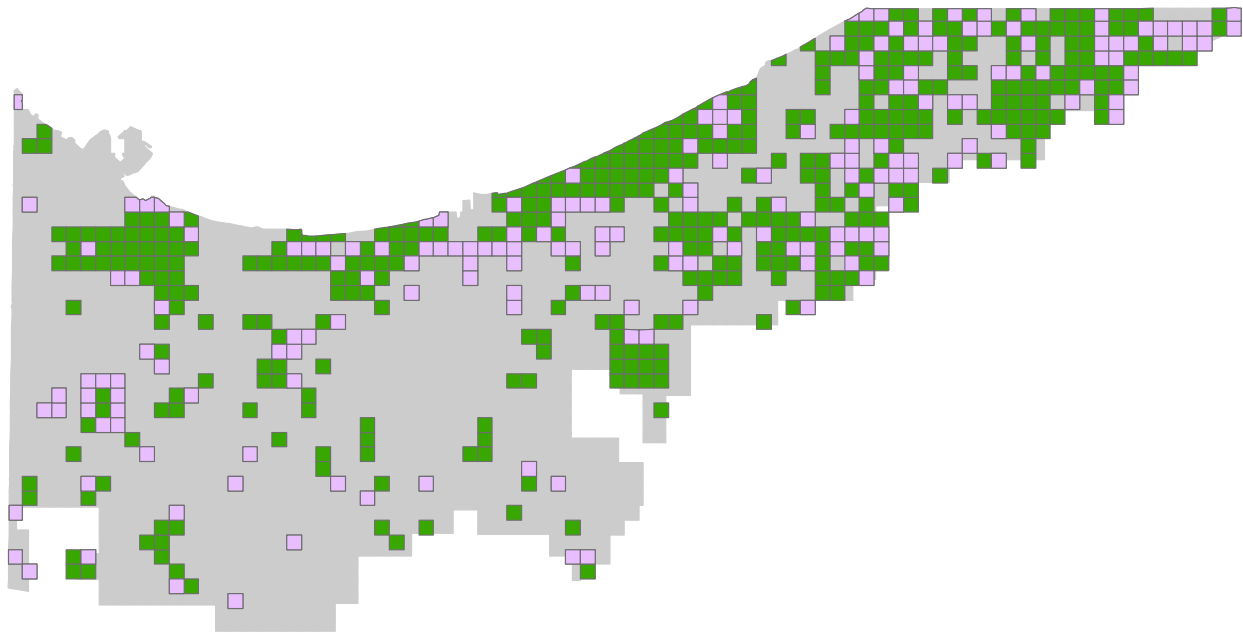


Figure 3. Recommended cells updated during the current project. Green areas indicate potential high-conservation cells identified in the original IBI process that did not have changes requiring updating. The violet cells are those containing one or more polygons that were modified (corrected and/or updated) during the present project.

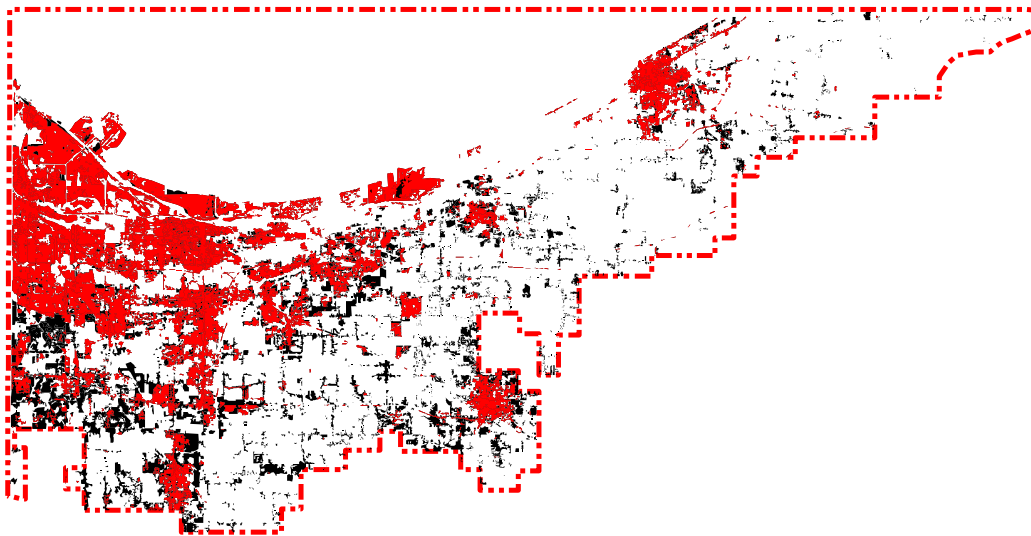


Figure 4. LMCP boundary showing the original extent of developed and urban areas in red and additional areas detected on 2003 color orthophotographs in black.

Change assessment in the areas recommended for conservation in the original IBI product. After the base habitat layers were updated, we conducted a change assessment in order to understand which habitats within the recommended cells had been most affected by land cover changes in the intervening years.

Low-density urban areas (suburbia) comprised the fourth largest land cover class in the 1992 classification; it advanced to third following the updates and corrections. High-density urban area went from fifth to fourth. Row crops and forests remained, respectively, first and second, but pasture/grassland fell from third to fifth.

Pasture/grassland and row crops had the greatest net losses (Table 3), some owing to misclassifications one for the other, but most owing to development. Terrestrial deciduous forest had similarly large losses. These three classes were the largest in the original 1992 classification, so the percent losses were concomitantly reduced, but still exceeded 10% in all cases and 25% for pasture/grassland. The “loss” of the “developed nonvegetated” class reflects primarily the urban reclassification – areas identified as developed nonvegetated in the original GAP classification (possibly because they did not have spectral signatures that fit well into high- or low-density urban classifications) were reclassified to high- or low-density urban during the overall urban-area check conducted during this project.

Land Cover	2003 acres (GAP update)	% of total area (update)	1992 acres (GAP)	Change (acres)	Change (ha)	Change (%)
Pasture/Grassland	33158	8.6	46278	-13120	-5310	-28.4
Row Crop	99174	25.8	111685	-12511	-5063	-11.2
Terrestrial Forest Deciduous	75614	19.7	86937	-11323	-4582	-13.0
Developed Non-Vegetated	9102	2.4	12682	-3580	-1149	-28.2
Unclassified Cloud/Shadow	93	0.0	809	-716	-290	-88.5
Water	6445	1.7	7146	-701	-284	-9.8
Palustrine Herbaceous Deciduous	9725	2.5	10411	-686	-278	-6.6
Palustrine Forest Deciduous	25421	6.6	25745	-324	-131	-1.3
Terrestrial Shrubland Deciduous	4011	1.0	4178	-167	-68	-4.0
Terrestrial Forest Mixed	1035	0.3	1093	-59	-24	-5.4
Terrestrial Forest Evergreen	897	0.2	949	-52	-21	-5.5
Palustrine Shrubland Deciduous	983	0.3	1013	-30	-12	-2.9
Palustrine Woodland Deciduous	124	0.0	152	-28	-11	-18.1
Terrestrial Woodland Deciduous	2744	0.7	2747	-3	-1	-0.1
Palustrine Sparsely Vegetated	457	0.1	406	51	21	12.5
Developed Urban High Density	41092	10.7	32245	8847	3580	27.4
Developed Urban Low Density	74610	19.4	39954	34656	14025	86.7

Table 3. Comparison of area in major land-cover classes in the original Indiana GAP map (1992) and following the ground and airphoto work on this project. Land-cover classes are ranked by magnitude of absolute change in area.

Changes in wetland types were also recorded on the NWI layer (Table 4). The original NWI layer for Indiana was finished in the early 1980s and was considered to be quite accurate at that time. Considering the age of the database, we found surprisingly little change, but this may be because the larger changes in wetland area were detected in the GAP database's generally larger wetland polygons (Table 3). Whereas the NWI changes are quite modest, with the largest change being a 30-acre gain in small ponds, the GAP wetland changes show approximately 1000 acres of wetland loss. The GAP loss of water habitat is primarily due to conversion of large bodies of water - hundreds of acres - at Burns and Indiana Harbors to developed industrial land cover.

Wetland Class	Total Area		Area Lost		Area gained		Net difference		
	ha	acres	ha	acres	ha	acres	ha	acres	% of class
Palustrine emergent	4289.2	1735.8	-7.8	-3.1	6.2	2.5	-1.5	-0.6	0.0
Palustrine forested	7756.1	3138.8	-29.8	-12.0	11.0	4.5	-18.7	-7.6	-0.2
Palustrine scrub/shrub	1154.6	467.2	0.0	0.0	3.8	1.5	3.8	1.5	0.3
Ponds	405.9	164.3	0.0	0.0	74.7	30.2	74.7	30.2	18.4
Other wetlands	881.2	356.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Overall	14486.9	5862.7	-37.5	-15.2	95.7	38.7	58.2	23.6	0.4

Table 4. Changes in National Wetland Inventory areas by wetland class.

Threat Assessment

Development. Development is the principal threat to habitat in the LMCP area of concern. We discovered during ground verification that even where a land-cover change may initially seem benign to wildlife – as when an agricultural field is allowed to revert to grasses and shrubs – such changes often result from purchase of the land for development that may not occur immediately. So although the apparent change increases useful habitat, the longer-term change is increased habitat loss.

To understand the likely pattern of development in the region, we consulted the Northwestern Indiana Regional Planning Commission report “2030 Connections.” Among the forecasts included in the report are maps of population change from 2000 to 2030, the 2030 anticipated growth areas, and the committed and 2030 proposed road network expansions.

Not surprisingly, areas of population change are most extensive on the western side of the LMCP area (Fig 5). The area affected by large decreases is greater than that affected by large increases, but note that the scale of decreases is much smaller than the scale of increases. The larger “decrease” category is for a decrease of ≥ 251 people/square mile, whereas the largest “increase” category is for an increase of ≥ 740 people/square mile.

The three counties within the Coastal Management Program boundary currently have very different population densities and change trajectories. Heavily urbanized Lake Co. had 975 persons/square mile according to the 2000 census. Over the periods 1990-2000 and 2000-2003, population change in Lake Co. lagged considerably behind state averages (1.9% vs. 9.7%, and 0.6% vs. 1.9%).

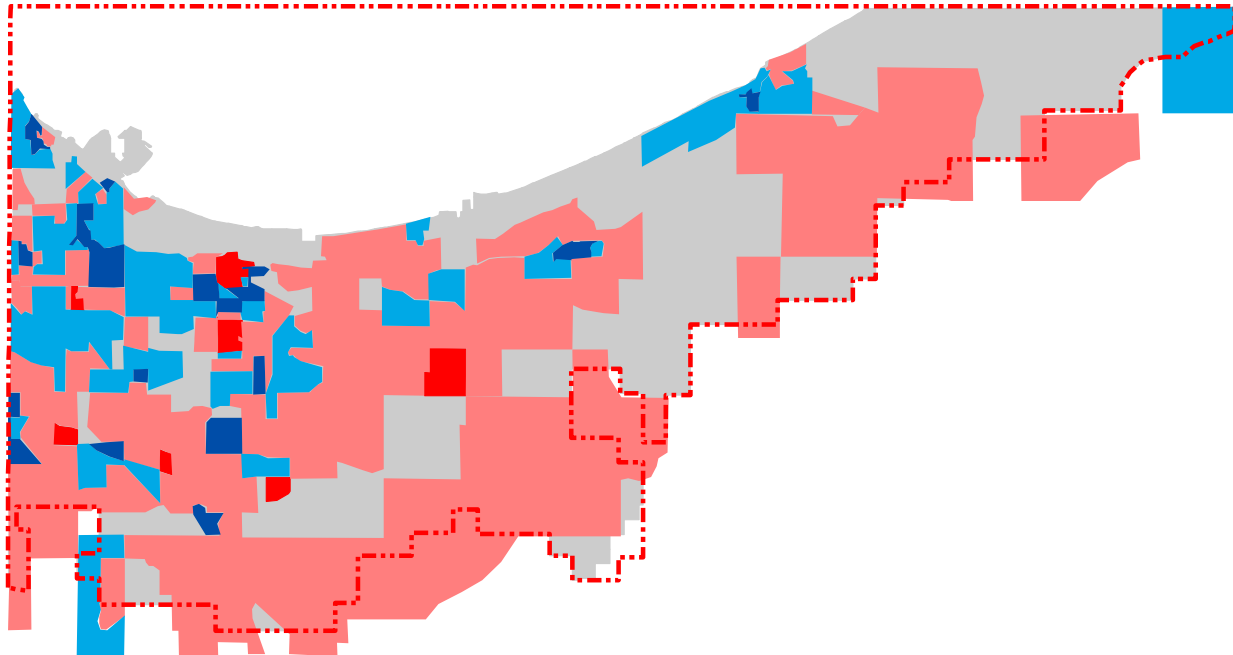


Figure 5. Areas where population is predicted to increase and decrease between 2000 and 2030, from the Northwestern Indiana Regional Planning Commission report “2030 Connections.” Pale red areas are predicted to increase by 26-740 persons/square mile. Dark red areas are predicted to increase by >740 persons/square mile. Light blue areas are predicted to decrease by 1-250 persons/square mile. Dark blue are predicted to decrease by >250 persons per square miles.

However, because of the high initial population densities, these lower proportional increases still reflect considerable influx of people. Unlike Lake Co., Porter Co., with 351.1 persons/square mile in 2000, grew faster than the state average over 1990-2000 and 2000-2003 (13.9 % vs. 9.7%, and 3.9% vs. 1.9%). Presumably this represents expansion of the Chicago-Gary influence zone. LaPorte County, with 184.1 persons/square mile in 2003, increased slowest of the 3 counties in 1990-2000 (2.8% vs. 9.7% in Indiana overall) and lost population during 2000-2003 (-0.2 persons/square mile). However, during ground truthing work in LaPorte Co., we saw several new developments in the planning or early stages (e.g., land no longer farmed, but not yet broken, or only initial earth moving begun). These tended to be single family homes, rather than apartment or condominium units, but in this sparsely populated, agricultural area, they represented a significant change in land use. Clearly, some of the predicted population increases are already beginning.

As we would expect, the highest concentration of potential high-conservation-value areas in the original IBI models was in the least urbanized area, in LaPorte County. Nevertheless, the two more urbanized counties contain over half the recommended areas, and virtually all recommended areas in the southern parts of Lake and Porter Counties are in development zones.

Predicted areas of residential growth (as indicated by municipal planning agencies) were rather evenly spread throughout the area (Figure 6). Most residential growth is predicted in areas that were not selected by the IBI modeling process. One concentrated area in LaPorte Co., at the southern edge of the LMCP boundary is an exception.

Areas with specific commercial, park, industrial, special use (as indicated by municipal planning agencies), like areas with predicted population increase, were more numerous in Lake and Porter counties than in LaPorte County (Figures 6, 7). The area involved is small relative to the IBI-selected cells, but there is a concentration in the Karner blue butterfly western conservation area (see Figure 17).

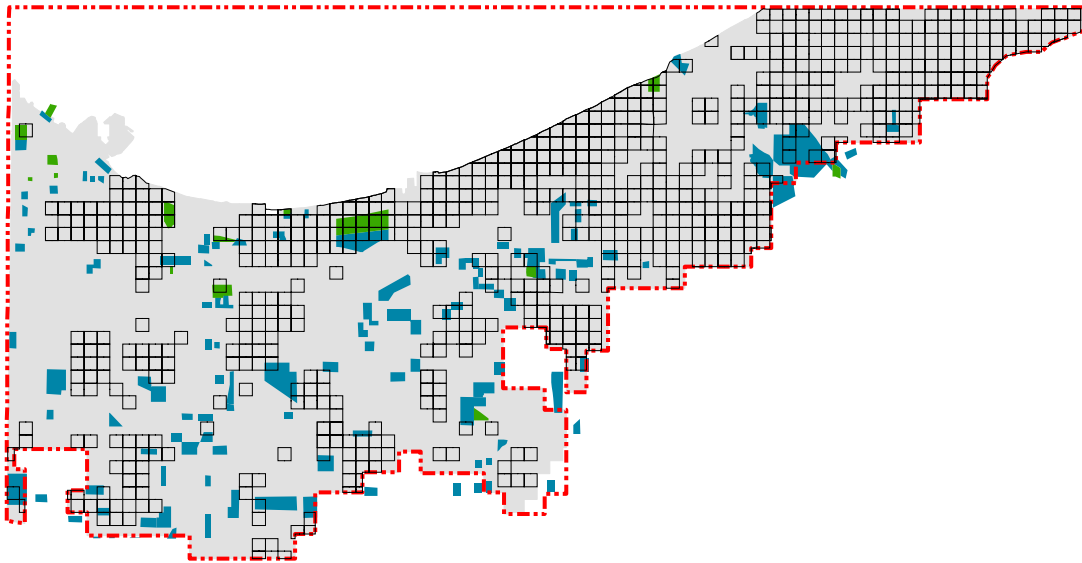


Figure 6. Predicted areas of residential development (blue) and open space (green), 2000-2030, from the Northwestern Indiana Regional Planning Commission report “2030 Connections.” Black outlines show LMCP-specific rerun Phase 1 and Phase 2 solutions.

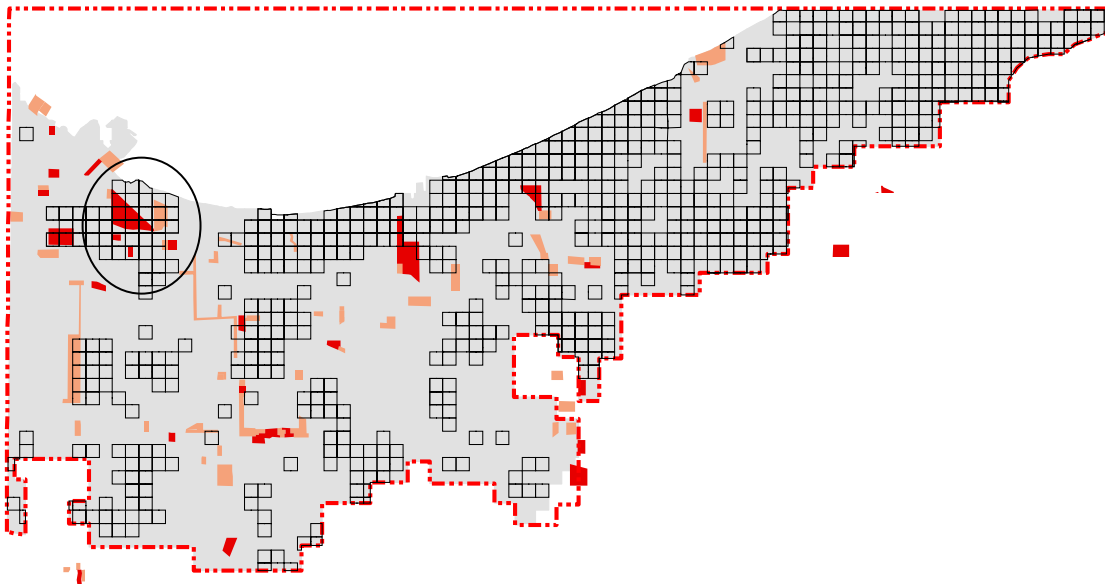


Figure 7. Predicted areas of commercial (orange) and industrial (red) development during 2000-2030, from the Northwestern Indiana Regional Planning Commission report “2030 Connections.” Black outlines show LMCP-specific rerun Phase 1 and Phase 2 solutions (areas of ecological importance). The circle indicates a concentration of predicted development in the western Karner blue butterfly conservation area.

The map of the 2030 proposed road network expansion did not entirely match the 2030 anticipated growth areas map, although there is a better match with the population change match (Figure 8). The proposed projects particularly intersect potential conservation area in the northwest of the LMCP area and along the west edge of LaPorte Co., where the urban update showed already existing development.

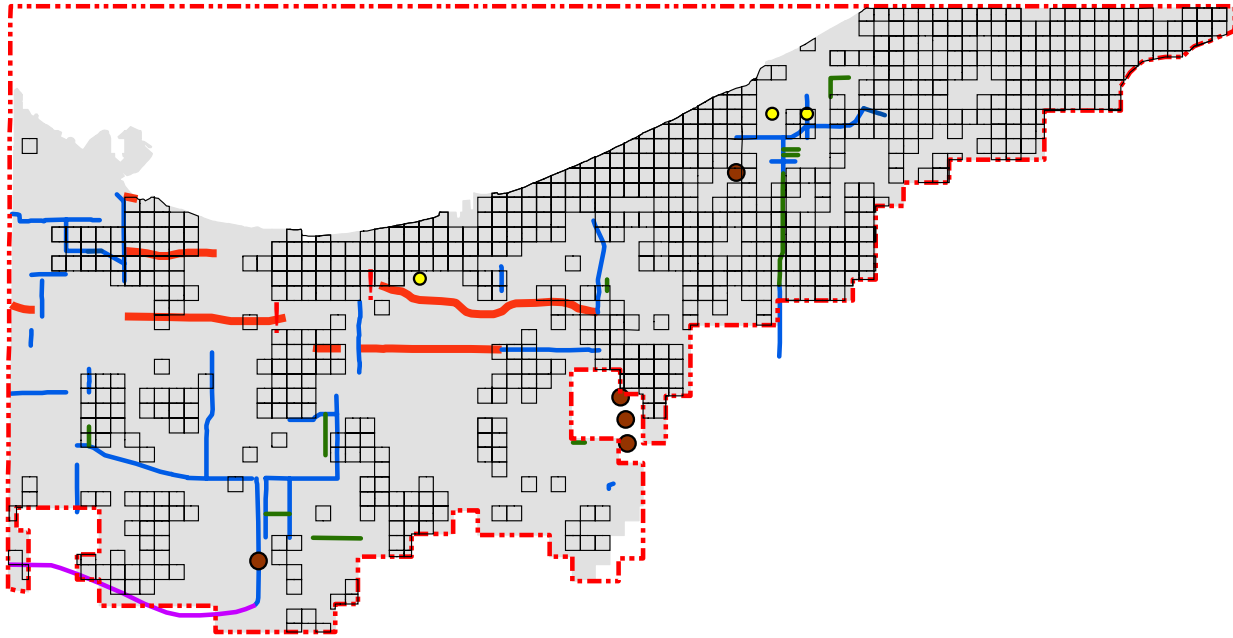


Figure 8. Committed and proposed transportation projects for 2000-2030 from the Northwestern Indiana Regional Planning Commission report “2030 Connections.” Black outlines show LMCP-specific rerun Phase 1 and Phase 2 solutions. Heavy red dots and lines show committed interchanges and roads. Purple lines show proposed new interstates, blue lines show proposed lane additions, green lines show proposed new roads, brown dots show proposed new interchanges and yellow dots show proposed interchange improvements.

Other threats to biodiversity we have not addressed that affect quality of recommended areas. In the Northwest Morainial region, long-term land management practices often alter the value habitat to plant and animal species. Plowing, mowing, fire suppression and hydrologic change are the primary anthropogenic practices affecting land cover in nonurban-suburban areas. Black oak savanna has largely become forest. Due to the high density of homes in these forests, a return to the historical fire regime is unlikely, but there are other management approaches that can restore savanna. Fire would once have helped keep prairies free of woody plants, as well, however most areas that were once prairie are now in agricultural land cover. Many wetter prairies and other wetlands have been ditched and drained to make them suitable for farming. Complete restoration is time consuming and may be impossible to achieve.

The IBI products identify areas on the basis of existing natural habitats which are often only generally defined. For example, areas identified as grasslands include abandoned fields, pastures, hayfields, and golf courses. Biodiversity in such areas may be improved, or protection may be increased by changing land management so that higher quality habitat results. In addition, protecting and restoring adjacent areas that are presently in manipulated land covers such as row crop. Thus, areas shown in IBI products are not necessarily at their most productive in terms of biodiversity, but, once protected, should be capable of improvement.

Invasive species threaten native habitats and complicate or defeat restoration efforts of all kinds. In the Northwest Morainal region, tree of heaven (*Ailanthus altissima*) is becoming well established in forests, where it replaces understory and overstory trees, alike. It reproduces profusely and seems entirely comfortable with the regional climate. Garlic mustard (*Alliaria petiolata*) invades forest understories, displacing spring ephemeral herbs and reducing the availability of host plants for butterflies and other insects. Purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and common reed grass (*Phragmites australis*) invade wetlands, reducing diversity of plants and animals. These are only examples of some of the broad categories. Control of these species is difficult once they become established – preventing establishment in the first place is the best course of action. The IBI products do not account for presence of invasive species, but distribution of particularly problematical species is often well understood, as are means for preventing establishment and control methods (if any). Existing protected areas or areas considered for future protection will benefit from strong invasive species control efforts.

Using project results to understand threats to conservation in the original IBI selected sites. The aerial photos are a powerful tool for investigating changes to specific IBI selected sites, as are the updated GAP and NWI layers. We were not able to ground-truth species sites from the Heritage database, but continued existence of relevant habitat serves as a partial check. In the accompanying GIS database, the "LMCP cells – conservation features" layer provides a summary of what phase of modeling selected each cell, what the areas of major habitat types were based on the original GAP, NWI, and Heritage data, and which specific animal models selected cells that were identified during Phase II modeling. By using the updated GAP and NWI layers, users can determine whether cells have changed, and whether the changes are likely to affect conservation value. Remember that some changes may increase conservation value, as when an abandoned field begins to grow back into natural cover.

The maps of predicted future land cover change are necessarily somewhat vague and provide only general guidance for predicting future sprawl. Special areas remaining in Lake and Porter Counties are likely to have high property values, and may have poor connectivity with other similar sites. However, where such sites have unique occurrences of rare species or high-quality communities, they may be well worth preserving. Many species do not require large area, although poor connectivity tends to result in the slow loss of species from small sites because chance events cause local extirpations, after which recolonization is unlikely. The conservation community is increasingly stressing creative solutions to connectivity. Along these lines, the Nature Conservancy Karner blue butterfly conservation model includes powerline corridors because these have tended to go undeveloped, leaving small linear patches of useful habitat.

LaPorte County obviously offers more, and probably less expensive, opportunities for large-scale conservation, including the establishment of networks of protected areas. This relatively positive circumstance is eroding under increasing development, although it seems likely that considerable time will elapse before LaPorte Co. is developed to the extent of Lake Co., for example.

There may be somewhat more enthusiasm for additional development in LaPorte than in Lake Co. (given the more depressed economy in the former) although resistance was also evident during field work. Signs protesting development plans were evident in more than one area. More noticeably,

where green space is rare, local populations may rally to support conservation use of remaining natural areas even where development profits might be quite high.

Rerunning the IBI Protocol on the LMCP Area

We used the updated databases to rerun both the Phase 1 (major and high-quality plant communities and rare plants) and Phase 2 (umbrella animal species) analyses within the LMCP area of responsibility.

Phase 1

Phase 1 was rerun with updated GAP, NWI, and Heritage databases. Largely as a result of the increase in urban areas, the rerun solution is only 92.6% of the area of the earlier solution (Table 5) and is shifted to the east relative to the earlier solution (Figure 9).

	Total		Outside Managed Areas	
	acres	cells	acres	cells
LMCP Area	406,232	1644		
Managed areas at time of rerun	44,782	181.3		
Original Phase 1 area	84,213	341	42,396	172
Rerun Phase 1 area	78,010	316	33,228	134.5

Table 5. Areas in LMCP area of responsibility, managed areas (for rerun), total Phase 1 area and total Phase 1 area outside managed areas for original and updated.

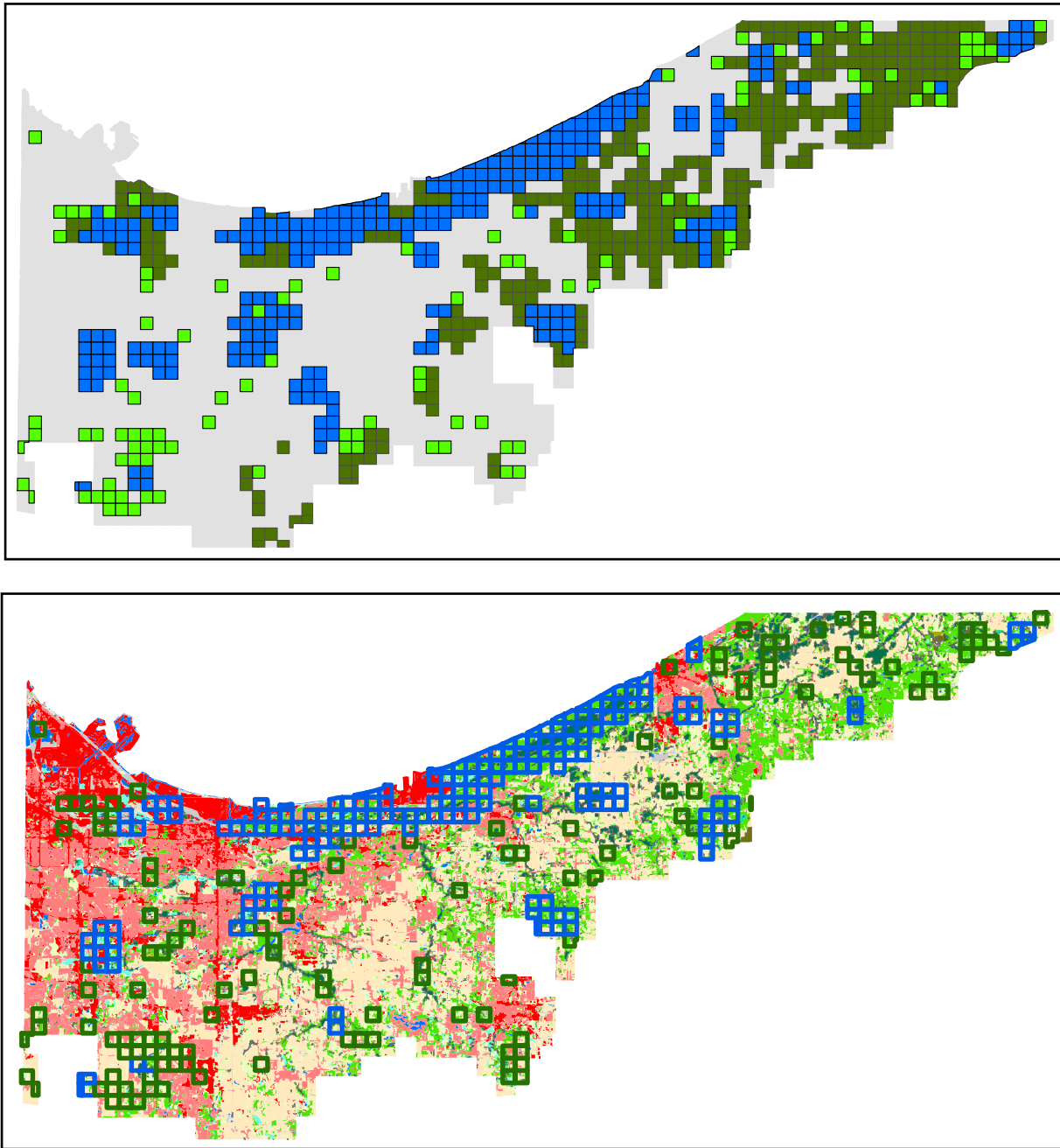


Figure 9. Upper pane: original phase 1 solution clipped from Northwest Moraine Natural Region. Lower pane: rerun Phase 1 solution showing managed areas (blue outline) and additional selected areas (green outline) over the updated GAP map. The GAP map shows urban areas in red, forested areas in green, wetlands and water in blues, and agricultural areas in light brown.

Phase 2

The rerun Phase 2 solution was 30% larger than the clipped Phase 2 solution from the Northwest Moraine Natural Region (Table 6). The same 8 species were used for both analyses, but the modeling process differed for some species between the two analyses. In particular, the wetland definitions used to find suitable habitat for blue-spotted salamander and Blanding's turtle were expanded to better interpret the intent of the model, resulting in increases in modeled habitat (Figures 10, 11).

	LMCP rerun		NWM within LMCP		change in	
	acres	grid cells	acres	grid cells	area	% change in area
American badger	4,198	17	7,134	29	-2,936	-41%
Blanding's turtle	23,396	96	13,494	55	9,902	73%
Blue-spotted salamander	78,967	323	34,050	139	44,917	132%
Eastern massasauga	51,199	209	26,805	109	24,394	91%
Golden-winged warbler	1,647	7	1,972	8	-325	-16%
Karner blue butterfly	33,467	145	11,248	46	22,219	198%
Red-shouldered hawk	16,574	69	32,827	141	-16,253	-50%
Scarlet tanager	13,694	59	29,247	90	-15,553	-53%
TOTAL	52,384	538	40,567	416	11,817	129%

Table 6. Comparison of Phase 2 solutions of the LMCP rerun and of the original Northwest Moraine Natural Region within the LMCP boundary.

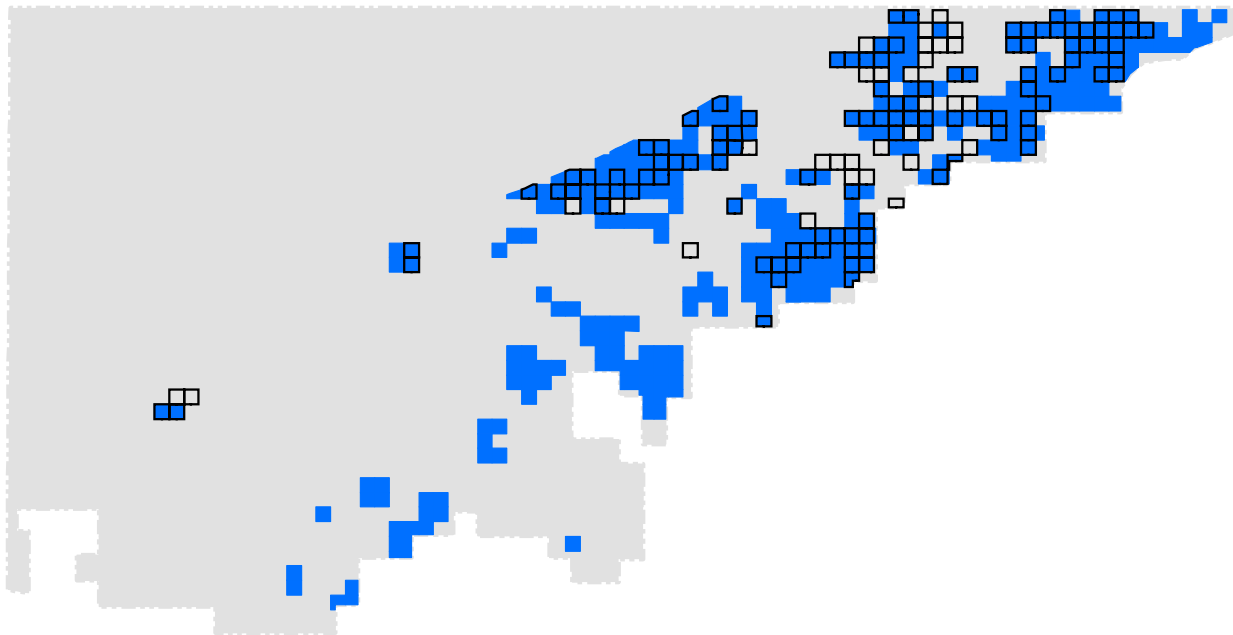


Figure 10. LMCP blue-spotted salamander solution (blue) with original natural region solution (outline).

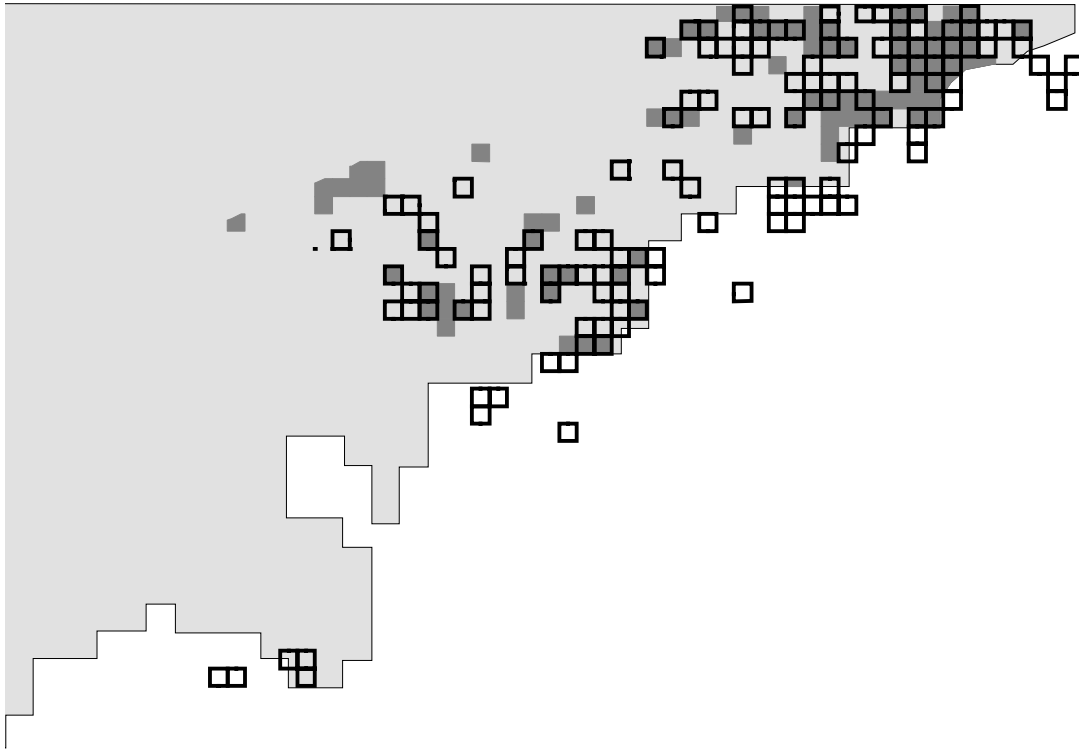


Figure 11. LMCP Blanding's turtle solution (grey) with original natural region solution (outline).

Decreases in badger, warbler, hawk, and tanager area (Figures 12-15) were likely a result of updates to urban areas in the GAP map. The changes in the area modeled as habitat for massasauga (Figure 16) are harder to understand. In theory, the same model was run in both instances, and there did not seem to be enough reclassification of habitat to account for the expanded area. The near doubling of area is unexplained. Possibly an error in parameter entry was not caught in the original model runs. After examining the aerial photos for selected areas, we are satisfied with the output of the present modeling runs for massasauga. The Karner blue butterfly map was expanded to include both eastern and western management units (Figure 17).

Interpreting model outputs

Phase 1 models are designed to preserve a part of all plant species and ecosystems recorded in the GAP, NWI, and Heritage databases. Even where only points (Heritage data) or small habitat patches (NWI) are involved, an entire grid cell will be designated for conservation in Phase 1. Cells in the worst conservation settings are eliminated during hand checking of Phase 1 output. However, given the intent to preserve all species and ecosystems, we try to err on the side of inclusiveness and countermand the model only in the cases where it seems very unlikely that restoration or habitat protection can be brought to bear. The overlay shapefile provides information on the which GAP habitats and general NWI categories fall within a grid cell, as well as the number of Heritage points in the cell and the umbrella species models that identified the cell. However, the C-Plan model used

in Phase 1 does not indicate what characteristics caused a cell to be selected. In using Phase 1 outputs for prioritization, users should bear in mind that Phase 1 selected cells are not created equal, in terms of high quality habitat or special features. Users' own goals will determine how Phase 1 results are best used.

Phase 2 models are designed to model habitat use by species whose habitat needs are similar to or encompass those of many other species in the ecosystem. Models are designed to capture the best habitat according to published data on the species.

Many places within the LMCP area that are not Phase 2 outputs may actually harbor these species. In some cases these areas may be sinks for species - places that attract animals but are more likely to kill than sustain them. Areas may be sinks due to mortality particular to urban and suburban settings (traffic, cats, dogs, etc.), lack of appropriate breeding habitat, or mortality from mesopredators tolerant of humans (e.g., raccoons). In the case of a species such as Blanding's turtle, adults may survive for long periods in sink habitat.

In other cases, umbrella species may be present in unmapped habitat because nonbreeding individuals often live in areas not suitable for breeding and rearing young, because published accounts of species needs do not completely represent acceptable habitat, or because available maps do not entirely or correctly identify all ground cover.

In any event, the purpose of mapping umbrella species is not to predict their occurrence, but rather to identify areas of good habitat that will support the umbrella species and other species with similar or overlapping habitat needs - areas that are good prospects for conservation actions. Appendix 2 provides technical details for each umbrella species model. Grassland, wetland, forest, and shrub species were selected, as well as the Karner blue butterfly, which uses small pockets of native herbaceous vegetation.

Note that several models accept pasture as acceptable primary or secondary habitat. Pasture is not always a high-quality habitat for species evolved for native grasslands; however, it is often the only potentially friendly habitat. As well, pasture (and the row crop with which it often alternates) can be restored to native species, whereas urban and suburban areas are generally not available for restoration.

Phase 2 models cannot speak to all aspects of animal needs. During meetings with the CELP group, several kinds of unmet need were discussed. Migratory stopover habitat for waterfowl and shorebirds, and corridor habitat (address in Phase 3, but not in detail) were some of the most urgent needs mentioned. Species with special habitat needs (large snags for nesting birds, specific larval food plants for Lepidoptera, e.g.) may also need additional considerations beyond those covered by the umbrella species models. Users whose responsibilities include such concerns will need to make use of other information, such as Important Bird Area maps, to ensure that specialized needs and non-resident habitat needs are met.

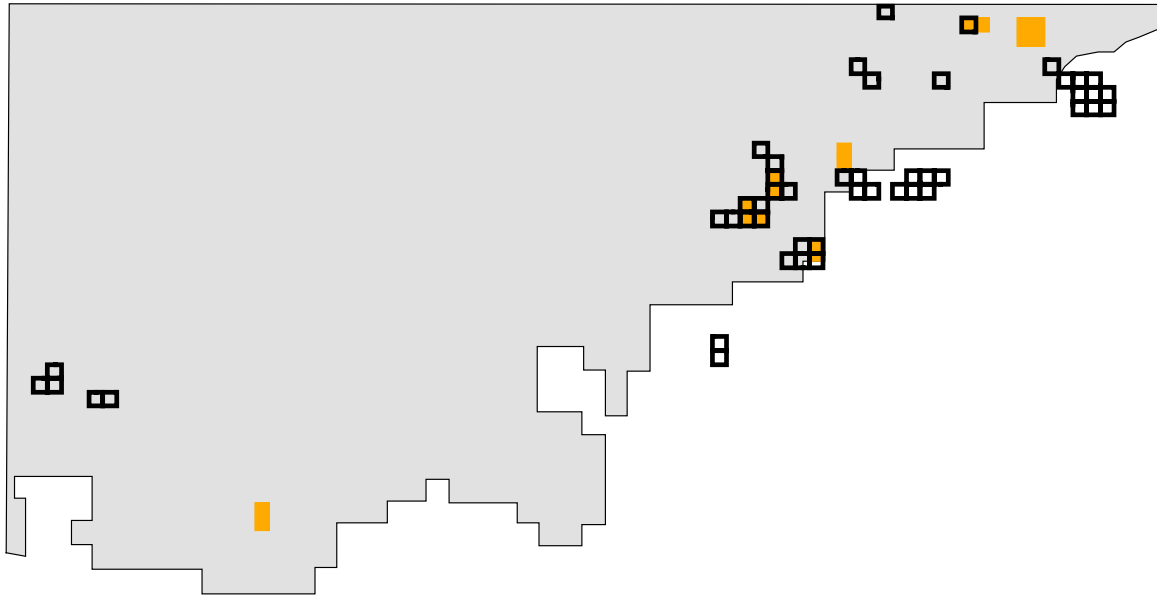


Figure 12. LMCP American badger solution (orange) with original natural region solution (outline).

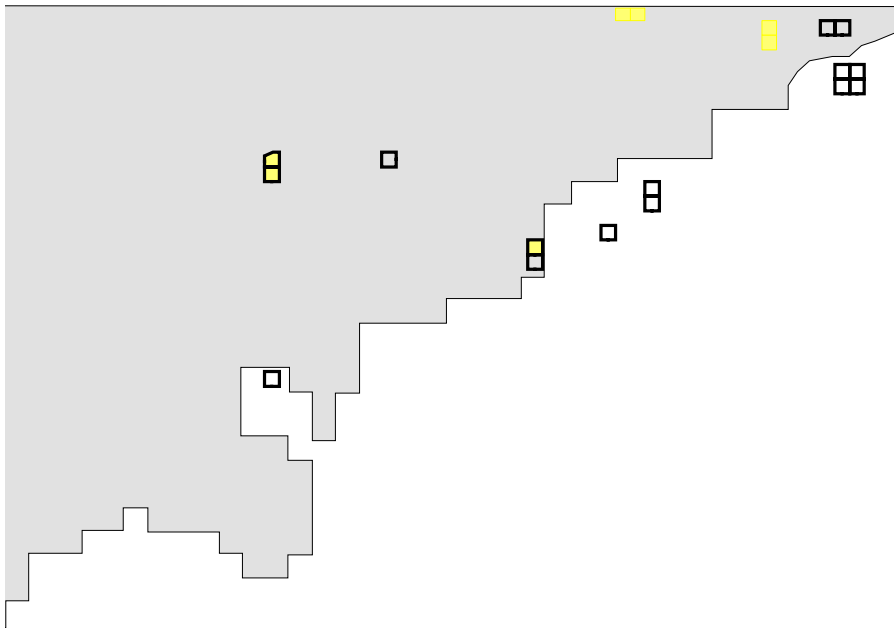


Figure 13. LMCP golden-winged warbler solution (gold) with original natural region solution (outline).

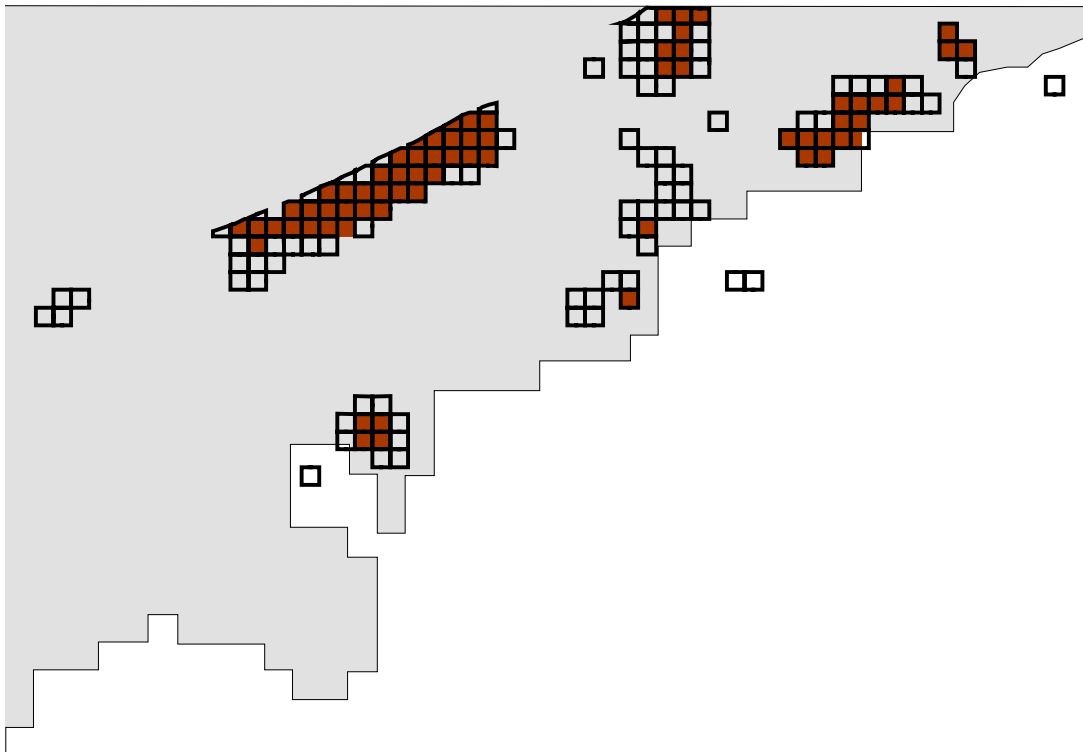


Figure 14. LMCP red-shouldered hawk solution (rust) with original natural region solution (outline).

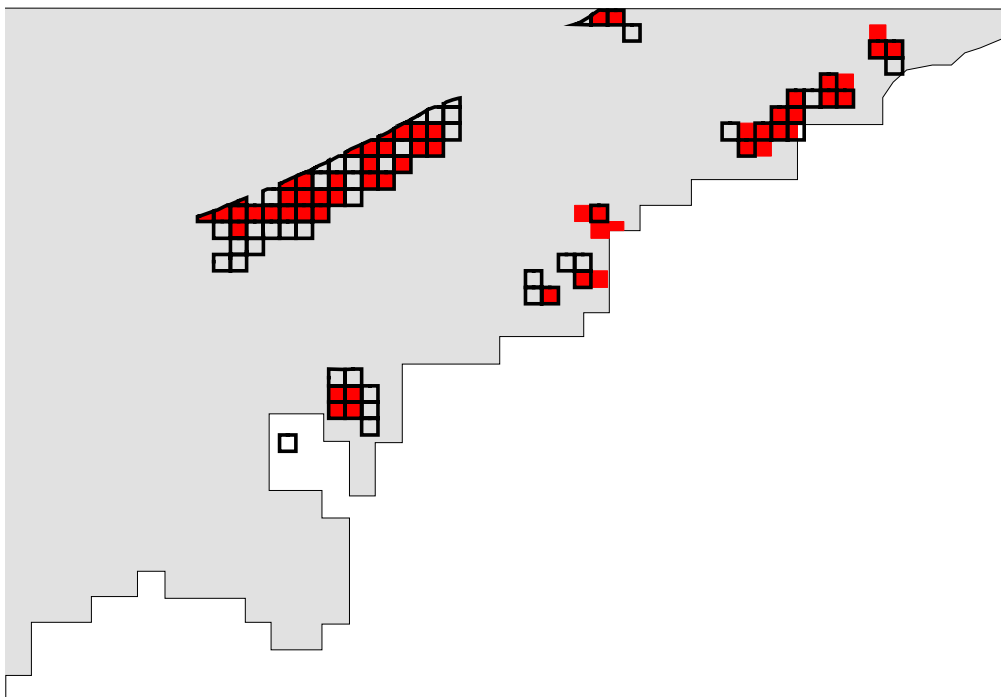


Figure 15. LMCP scarlet tanager solution (red) with original natural region solution (outline).

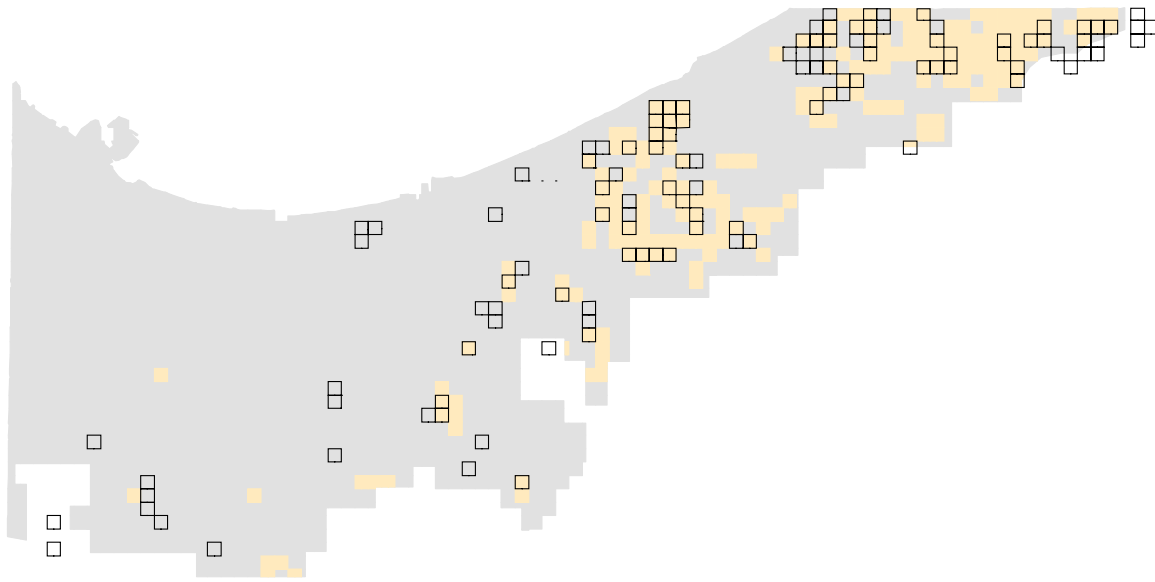


Figure 16. LMCP eastern massasauga solution (brown) with original natural region solution (outline).

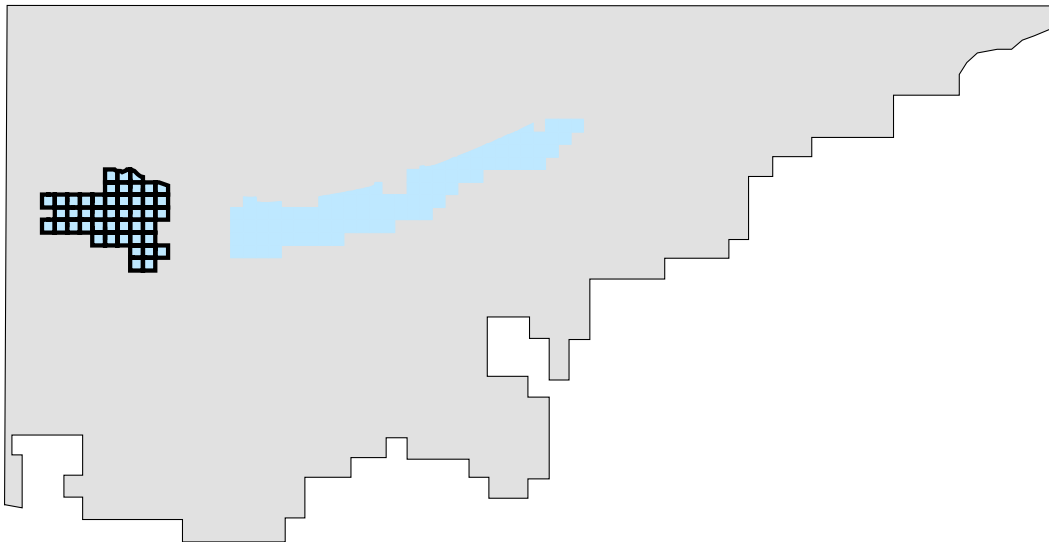


Figure 17. LMCP Karner blue butterfly solution (blue) with original natural region solution (outline). Changes here are not the result of modeling but only of more complete communication with species specialists to obtain the full set of conservation areas.

APPENDIX B: Categories of Areas of Particular Concern

The list of APC currently contains six categories. This appendix contains information from Chapter 8 of the INDIANA LAKE MICHIGAN COASTAL PROGRAM AND FINAL ENVIRONMENTAL IMPACT STATEMENT APRIL 2002, and identifies general areas of particular concern in the coastal region.

Areas of unique, scarce, fragile or vulnerable natural habitats

The natural heritage of Northwest Indiana contains many unique and vulnerable natural habitats formed from the advance and retreat of the glaciers and the migration of species from all geographic directions. Many natural communities developed as the glaciers retreated, each supporting a unique assembly of plants and animals, and each requiring natural disturbances to maintain that assembly. Natural communities in the coastal region include beach and fore dune, forest, wetland, prairie, and lake. Together, the natural components of these communities are what constitute biological diversity or biodiversity.

“Settlement affected three factors that historically maintained Indiana’s biological diversity: fire, water levels, and regeneration of forests.”⁴ The loss and degradation of northwestern Indiana’s prairies, wetlands, forests, dunes, and the resulting loss of plants and animals has left many surviving areas vulnerable to further degradation.

The Indiana Natural Heritage Program identifies and tracks the status of key biodiversity features. The Natural Heritage Program has identified 314 elements within Indiana’s Coastal Program Area that are critically imperiled, imperiled, or rare on a global scale. These include animal and plant species as well as natural community types. The Natural Heritage Program has documented the occurrence of these elements at over 1,572 locations in the Lake Michigan watershed. The information provided by the Indiana Natural Heritage Program is valuable for conservation planning; however, much is still not known about the biodiversity of Indiana’s coastal area. Inventories are incomplete for certain element groups, including aquatic elements, invertebrates and non-vascular plants such as mosses and lichens.

Over 1,000 native plant species occur in the region, which makes Indiana’s coastal area one of the most botanically rich areas in the United States. This wealth of plant biodiversity includes plant species found nowhere else in the state or in the Southern Lake Michigan basin. Many of the area’s animal communities, including grassland birds, woodland birds, savanna reptiles and amphibians, marsh reptiles, and amphibians, prairie insects, and savanna and woodland insects, are also both locally and globally important for conservation.⁵ The coastal area also harbors the highest number of endangered, threatened, and rare species in Indiana (4 amphibians, 28 birds, 2 fish, 17 insects, 3 mammals, 8 reptiles, and 218 plants).

⁴ Environmental Law Institute 1995. Indiana's Biological Diversity: Strategies and Tools for Conservation.

⁵ Chicago Wilderness, June 30, 1999. Biodiversity Recovery Plan.

In 1979, DNR conducted an inventory of natural areas in the watershed. The inventory located 258 parcels that required further investigation to determine habitat quality. After field investigation, 30 parcels were found to be notable for their importance on a regional level for teaching, research, public enjoyment, and as wildlife areas. However, notable areas did not meet the more stringent criteria for designation as statewide significant natural areas. Seventeen areas were identified as statewide significant natural areas with a total of 1,290 acres. Several of these sites contained ‘very high’ and ‘high’ quality natural communities.⁶

In 1996, an effort was made to revisit all the high quality sites identified in the 1979 study. Additional areas that had been located in subsequent years were also investigated. This study found that the majority of the sites identified in 1979 were still intact and several of them can be considered protected. Many of the additional sites were also protected in whole or in part. In total, 36 sites were at least partially protected but 17 sites were no longer considered to be natural areas. Protection ranged from federal, state, local, and non-profit organizations such as the Indiana Dunes National Lakeshore, DNR Division of Nature Preserves, Lake County Parks, the Nature Conservancy, and the Shirley Heinze Fund. Although there has obviously been considerable success in protecting these important natural treasures, some have been lost as natural areas. Most of those lost were degraded as the result of invading exotic plants, two were lost to woody encroachment, and five were lost to development activities.⁷

At least one high quality example of most of the natural community types was found to be protected in 1996. However, examples of northern sand flatwoods and several types of seeps are not currently protected. The 1996 study also found most natural areas had been lost in recent years from degradation due to invading exotic plants and shrubby encroachment.⁸

Conservation of Indiana’s biodiversity provides numerous benefits including commercial uses for food, fuel, fiber, and other products; support of fishing and hunting and use of other natural products; recreational opportunities; scientific research; and ecological services such as photosynthesis, water purification, and flood control.

Areas of historical significance, cultural value, or substantial recreational value or opportunity

Indiana has a rich heritage of significant historical and cultural resources that place Hoosiers in our national history and provide substantial recreational and educational value. Northwestern Indiana’s cultural resources include: Prehistoric and historic archaeological sites and resources; Early settlement resources; Ethnic heritage and resources; Agricultural resources and farmsteads; Wood, metal, and concrete bridges; Educational institutions and libraries; Social institutions, fraternal

⁶ Indiana State Planning Services Agency April 30, 1979. Prepared by Indiana Department of Natural Resources and Natural Land Institute. An Inventory of Natural Areas in the Indiana Coastal Zone Study Area, Technical Report No. 302.

⁷ Indiana Department of Natural Resources, Division of Nature Preserves April 1998. The Status of Natural Areas in Indiana’s Coastal Zone: A comparison: 1979-1996.

⁸ Indiana Department of Natural Resources, Division of Nature Preserves April 1998. The Status of Natural Areas in Indiana’s Coastal Zone: A comparison: 1979-1996.

orders, and religious resources; Social welfare institutions; Transportation-related resources; Urban planning and historic designed landscapes; Industrial resources; and Resources from the recent past.

However, threats to these resources are common. Common threats include closure and demolition of buildings and transportation facilities, the decline of main streets and downtown areas, the lack of preservation ordinances in historic districts, and the lack of legal protection for post-1816 archaeological artifacts.⁹

The DNR conducted an inventory of cultural and historic resources for the coastal area. The Indiana Historic Sites and Structures Inventory has been a continuing program of the State's Division of Historic Preservation and Archaeology since 1975. This inventory identifies and records all potentially important historic buildings, bridges, sites, and other items on inventory forms and computer databases. In addition, the Division of Historic Preservation and Archaeology added a new database and survey of historic bridges in 1987 that combines the records from other state and local inventories. Engineering landmarks, such as iron, timber, and historic masonry bridges are being identified, recorded, and cataloged into the Historic Bridge Survey and Database Program.

A similar program exists for archaeological resources. The DNR Division of Historic Preservation and Archaeology is the central repository for archaeological records and initiates a statewide inventory. In 1998, the coastal region had over 1,336 archaeological sites. However, each year, new sites are recorded and logged into the Division's archaeological survey files.

In 2000, the DNR conducted a study, in cooperation with a focus group of local experts, of existing plans for the protection and restoration of historic and cultural resources in the Lake Michigan watershed.¹⁰ This study identified the themes and sites that were most often named by local plans as significant in the historic and cultural development of the region. The themes identified represent the various types of resources found in the watershed. They are downtown commercial districts; industry; residential districts; transportation; agriculture; natural-green space; recreation-green space; significant architecture; culture education; culture-religious; culture-sculpture; railroad; cemeteries; bridges; and Native American sites.

Ancient shipwrecks also represent an important cultural and historical resource for Indiana and the Lake Michigan coastal area. Based on archival and documentary research, the 225 square miles of lakebed controlled by Indiana are thought to contain as many as 50 shipwrecks for vessels lost since the 1830's. The largest number of prospective shipwrecks in the Indiana waters of Lake Michigan date from 1851 through 1900, while the greatest number of known shipwrecks is for the period between 1880 and 1920. The 36 wrecks of this period, 13 of which sank between 1871 and 1880, represent over 70% of the total prospective inventory. A broad spectrum of vessel types is included in the inventory. Among them are bulk freighters (lake types, self-loaders, and cannallers), passenger ships (lake types and side wheelers), package freighters, and car ferries. Serious efforts to

⁹Indiana Department of Natural Resources, Division of Historic Preservation and Archaeology. Indiana's Cultural Resources Management Plan 1998-2003.

¹⁰Indiana Department of Natural Resources. The Coastal Historic and Cultural Resources of the Lake Michigan Watershed. January 2001 by Shive-Hattery, Inc. www.state.in.us/dnr/lakemich

inventory shipwrecks within Indiana waters of Lake Michigan did not begin until the mid-1980s. By 1989, 14 vessels had been located and eight inventoried.

Additional data is needed to gain a full understanding of this cultural resource. Submerged within the southern limits of Lake Michigan, often in shallow water, shipwrecks are exposed to numerous natural and human impacts. All of the shipwreck sites within the Indiana inventory have been affected by vandalism and looting. In most instances, the easiest items to remove from a site have already been removed. However, today there is a better understanding among sport divers of the need to protect sites for their own and the future enjoyment of others.

Substantial recreational value is also derived from natural and cultural resources in the coastal area. The Statewide Comprehensive Outdoor Recreation Plan (SCORP), produced by the DNR, evaluates recreational opportunities for Indiana. The primary provider of outdoor recreation lands in Indiana is the public sector. Federal, state, and local government agencies provide the majority of recreation facilities and open space in Indiana. In the 1994-1999 SCORP, total public recreation acres of Lake, Porter, and LaPorte counties was found to be 34,425.67 acres which equates to a total recreation acres per person of 0.048 acres.¹¹ The National Park and Recreation Association has recommended standards for the amount of recreation and open space provided to citizens. Recreational planners can use these standards as a tool to measure how recreation space availability compares to the population that uses it. The standard for local recreation space is approximately 0.02 acres per person or 20 acres for every 1000 people.¹²

Lake Michigan's beaches and access for water recreation is an important facet of the coastal area's recreational opportunities. In 1996, the LMCP and the Division of Outdoor Recreation surveyed people using the lakeshore. The top three activities were swimming, power boating, and picnicking. Other top activities were nature observation, hiking/walking, and boat fishing.¹³ In addition to a survey of lakeshore users, focus groups met to discuss issues associated with recreation. "In general, the majority of the attendees felt there is a lack of adequate access to the lakeshore. Along with the basic deficiency, people felt the access that did exist was inconsistent in pricing, hours open, security, facilities offered, access for persons with disabilities, and policies and enforcement."¹⁴

Areas of high natural productivity or essential habitat for living resources, including fish, wildlife, endangered species, and the various trophic levels in the food web critical to their well-being.

Wildlife management has long recognized that certain habitats provide essential resources at key life stages for many species. Without these essential habitats, species populations can be dramatically affected. Essential habitats that support key life stages include breeding grounds, migratory stopover habitat, rearing habitat, and wintering habitat. Essential habitats can include a range of habitat types for one species. For example, many reptile and amphibian species require

¹¹ Indiana Department of Natural Resources, Division of Outdoor Recreation, 1994. Statewide Comprehensive Outdoor Recreation Plan 1994-1999. P. 127.

¹² Indiana Department of Natural Resources, Division of Outdoor Recreation, Statewide Comprehensive Outdoor Recreation Plan 1994-1999.P. 114.

¹³ Indiana Department of Natural Resources, 1998. Lake Michigan Indiana Recreational Access Guide. P. 9.

¹⁴ Indiana Department of Natural Resources, 1998. Lake Michigan Indiana Recreational Access Guide. P. 5.

aquatic habitats for breeding and for the development of their young. These aquatic habitats, sometimes only temporary wetlands, provide needed food, water, and protection from predation. During the remaining stages of life these species use other types of habitat including dry woodlands. Other species use different habitat types during the fall and winter. Copperbelly water snakes move from dry forest habitat to wetlands each spring where their main food supply exists, and they return to their forest dens in the fall.¹⁵

A second example of a key life stage is the need for migratory stopover habitat for thousands of birds that migrate between breeding and wintering grounds. Northwest Indiana is part of the Mackenzie Valley- Great Lakes-Mississippi Valley route of migration. Although much of today's knowledge of this migration route relates primarily to waterfowl, it is known that a large number of many species migrate through this region. Species of ducks, geese, shorebirds, blackbirds, sparrows, warblers, and thrushes use this migration route. The Mackenzie Valley-Great Lakes-Mississippi Valley route extends from the Mackenzie Valley in Alaska, covers the Great Lakes, and turns down the Mississippi Valley making it the longest in the Western Hemisphere.¹⁶

The shoreline is especially important for migrating birds. "Lake Michigan affects the movement and distribution of birds by acting as an obstacle to migrants. The shores of this enormous lake provide leading lines that control flight paths of numerous migrants."¹⁷ Migration distances can be substantial and the resulting loss of body fat makes it essential to immediately land for rest and feeding. The need to 'refuel' "generates an anomalously high concentration of passerines in park woodlands immediately adjacent to the lake."¹⁸ One group of migratory birds, referred to as neotropical migrants, migrate long distances to breed in northern forests and spend winter in the tropics. In Indiana, over 40 Neotropical migratory bird species are species of special management concern because of declines in their populations.¹⁹ A second group of birds requiring stop-over and coastal breeding habitat are shorebirds. Although the majority of shorebirds migrate to the arctic circle in the spring, a few species such as the Piping Plover, listed as a federally endangered species, reproduce in the coastal and interior regions. From 1930 to 1987, the piping plover was considered common. The plover vanished as a nesting species from many areas beginning in the 1930s, with dramatic losses in the Great Lakes region. Censuses as recent as 1997 accounted for only 3,500 to 4,200 individuals throughout the range of the species. The causes for this drastic decline can be linked to the loss or alteration of nesting and wintering areas.

In May of 2001, the U.S. Fish and Wildlife Service designated critical habitat for the piping plover. Critical habitat is a term used in the Endangered Species Act of 1973, as amended. It refers to specific geographic areas that are essential for the conservation of a threatened or endangered species and that may require special management consideration or protection. These areas do not necessarily have to be occupied by the species at the time of designation. This means that areas

¹⁵ Environmental Law Institute 1995. *Indiana's Biological Diversity: Strategies and Tools for Conservation*, P. 24. Environmental Law Institute, Washington D.C.

¹⁶ Lincoln, Frederick, C. and Steven R. Peterson. 1979. *Migration of birds*. Circular 16, U.S. Department of the Interior, U.S. Fish and Wildlife Service, Washington, D.C. Northern Prairie Wildlife Research Center Home Page. <http://www.npwr.usgs.gov/resource/othrdata/migratio/migratio.htm> (Version 16JAN98)

¹⁷ Brock, Kenneth J. 1986. *Birds of the Indiana Dunes*. Bloomington: Indiana Univ. Press, 1986. 178 pp

¹⁸ Brock, Kenneth J. 1986. *Birds of the Indiana Dunes*. Bloomington: Indiana Univ. Press, 1986. 178 pp.

¹⁹ Environmental Law Institute 1995. *Indiana's Biological Diversity: Strategies and Tools for Conservation*, P. 8. Environmental Law Institute, Washington D.C.

must be identified which will allow for the protection of the current population, and any population increases that may be required to achieve recovery (allowing the species to be removed from the endangered species list). In Indiana, critical habitat for the piping plover has been designated by the U.S. Fish and Wildlife Service on 4.9 miles of Lake Michigan shoreline in Porter County. It includes areas that were historically occupied by piping plovers. The designation includes 3.1 miles of Indiana Dunes State Park Shoreline and 1.8 miles of Indiana Dunes National Lakeshore shoreline. The area extends from the western boundary of the Cowles Bog/Dunes Acres lakeshore unit, east of the Port of Indiana and the NIPSCO Baily Generating Station and along the Indiana Dunes State Park to Kemil Road at Beverly Shores.

Fisheries management has also focused on essential habitat needed for a productive population of both game and non-game species. Near shore waters are essential for nearly all species of Great Lakes fish “for everything from permanent residence, to migratory pathways, to feeding, nursery grounds, and spawning areas”.²⁰

Fish species have specific requirements for conditions on spawning grounds. For example, salmonid species require cool water temperatures and a gravel streambed for spawning. Salmonid species return to the same general location to spawn, making these areas essential for many generations of Salmon. Wetlands and riparian corridors represent highly productive habitats. Riparian corridors can provide nutrients, shade, and microhabitats for many levels of the aquatic food web. Without the interaction between riparian corridors and the stream, productivity of the aquatic habitat is diminished.

Wetlands are extremely productive due to the many functions they serve in the landscape. Wetlands provide flood control, improve water quality, support productive fish habitat, provide principal habitat for many waterfowl, support an enormous diversity of plants, recharge groundwater, reduce erosion on streams and lakes, and support a multi-billion dollar fishing, hunting and outdoor recreation industry.²¹ “The fact that the majority of the wetland resources once present in Indiana have been lost or altered makes wetlands especially critical resources for conservation.”²²

The National Wetlands Inventory by the U.S. Fish and Wildlife Service initiated in 1981 identified and classified Indiana's wetlands at a regional scale. Analysis of this data shows that the Lake Michigan region contains about 7, 242 wetlands covering a total of approximately 65 to 68 square miles or roughly 11% of the total land area.²³ It was also determined that approximately 98% of the region's wetlands were classified as palustrine wetlands and these constituted about 92% of the total wetland area. Approximately 6% of the wetland area was lacustrine wetland and 2% was riverine wetland.²⁴

²⁰U.S. Army Corps of Engineers, Detroit District, and the Great Lakes Commission 1999. *Living with the Lakes: Understanding and Adapting to Great Lakes Water Level Changes*. ISBN 0-9676123-0-6.

²¹ World Wildlife Fund, 1992 *Statewide Wetlands Strategies: A Guide to Protecting and Managing the Resource* P. 4-6. Island Press, Washington, DC

¹⁹ Indiana Department of Natural Resources, June 1996. *Indiana Wetlands Conservation Plan*. P. 1

²³ Indiana Department of Natural Resources, Division of Water, 1994. *Water Resource Availability in the Lake Michigan Region, Indiana*, P. 64. State of Indiana.

²⁴ Indiana Department of Natural Resources, Division of Water, 1994. *Water Resource Availability in the Lake Michigan Region, Indiana*, P. 64. State of Indiana.

In 1979, the DNR selected and studied 45 wetland areas of greater than 25 acres within the Lake Michigan watershed. Following field inspection and cover typing, the wetlands were rated based on size, type, diversity, fisheries, adjacent development, and adjacent land use.²⁵ In 1996, the top 25 priority sites were revisited by the DNR Division of Nature Preserves to reevaluate and determine whether the wetlands had changed in terms of size, cover type, and context. In general, the wetlands were basically intact. All were at least as large as they were in 1979, and two had increased in size due to a man-made pond and cropland reversion. A major trend was that certain types had become more bushy and woody and in a few cases exotic species had invaded. The biggest change was that many had become more urbanized in context. More than half of the wetlands have some housing developments, industrial sites, or a golf course as a neighbor. So, while none of the wetlands have been filled or destroyed, their integrity is now somewhat threatened due to adjacent development. As of January 2001, only seven of the 25 priority wetlands are under some form of protection.²⁶

The DNR Division of Fish and Wildlife has designated public and private lands that provide productive habitat for fish and wildlife through the voluntary Classified Wildlife Habitat Program. These are areas capable of supporting wildlife species and are managed by the standards of good wildlife management.

The Division of Forestry has also designated productive public and private lands that maintain a healthy forest environment through the voluntary Classified Forest Program

Areas needed to protect, maintain, or replenish coastal lands or resources including coastal flood plains, aquifers and their recharge areas, sand dunes, and offshore sand deposits

The interaction of surface and groundwater maintains and replenishes wetlands, flood plains, and aquifers. Some areas such as wetlands are sites of groundwater discharge, where groundwater moves towards the surface. Other sites, or sometimes the same sites under differing environmental conditions, recharge aquifers and the groundwater. The recharge potential of wetlands is affected by many factors including wetland type, location, season, soils, and precipitation, and appears to be more important in small wetlands than large ones.²⁷ Based on the National Inventory of Wetlands, about 40% of the Lake Michigan region's wetlands are one acre or smaller; 48% are between 10 and 40 acres; and 2% are greater than 40 acres. Location serves a vital role in determining the contribution of these wetlands to the aquifer.

The interaction between ground water and surface water can also moderate seasonal water level fluctuations. During dry periods, ground water discharge can help maintain water levels in streams. For example, the surface sands in the northern part of the region, the Calumet Aquifer, allow discharge from the ground water to Lake Michigan, the Little Calumet River, and to the Grand Calumet River. However, streams can also recharge ground water through saturated flood plain soils or through streambeds when the water table falls below the elevation of the water's surface.

²⁵ Indiana State Planning Services Agency April 30, 1979. Prepared by Indiana Department of Natural Resources. A Priority Rating of Selected Wetlands in the Indiana Coastal Zone Study Area, Technical Report No. 303

²⁶ Indiana Department of Natural Resources April 1998. The Status of the Top 25 Priority Wetlands in Indiana's Coastal Zone: A Comparison 1979-1996.

²⁷ Indiana Department of Natural Resources, June 1996. Indiana Wetlands Conservation Plan. P. 12

The complexities of the major aquifer systems and the importance of recharge areas were assessed by the report, “Atlas of Hydrogeologic Terrains and Settings of Indiana”. The report describes the Lake Michigan region as having two hydrogeologic environments, the Valparaiso Moraine and the Lake Border.

The Valparaiso Moraine consists of a variety of geologic settings formed by the movement of the glacial ancestor of Lake Michigan. The most extensive setting within the Valparaiso Moraine is the exposed outer outwash fan between the city of Valparaiso and the Michigan state line. The exposed outer outwash fan is mainly a gentle sloping surface underlain by thick sand and some gravel. “Large areas of the eastern part of the exposed fan in LaPorte County are intensely pitted, reflecting collapse caused by melting of buried ice blocks. Many of the resulting depressions are bogs filled with peat and muck.”²⁸

Within the outwash fan is a belt of several places with irregular topography, referred to as an inner collapsed fan head. This setting represents one or more ice front positions and contains fine-grained sediments of irregular thickness atop coarse fan sediments.²⁹ The exposed outer outwash fan and the inner collapsed fan head have the characteristics of recharge areas. In addition, “the greatest sensitivity to contamination in this region is likely to be associated with those parts of the outer exposed fan characterized by a relatively shallow zone of saturation”.³⁰

The Lake Border is the area between the north edge of the Valparaiso Moraine and Lake Michigan. This section contains beach and near shore features, dunes, beach ridges, and interdunal wetlands. The “Atlas of Hydrogeologic Terrains and Settings of Indiana” describes two components to the Lake Border: 1) a shallow water table associated with the dune and swale regions and other areas of surface sand and 2) deeper systems of various confined and semi-confined sand and gravel aquifers. The “entire lake border terrain is predominantly a regional discharge area for confined aquifers, with strong upward gradients typical; the ground water flow pattern is much more localized in surface sandy soils, with dunes and swales acting as local recharge and discharge areas, respectively.”³¹ The surficial aquifers and some of the deeper ones are hydrologically connected in areas along streams such as the Deep River.³² The Lake Border setting also has a shallow ground water system, except beneath the largest dunes, and has high rates of infiltration. These characteristics increase its sensitivity to contamination.

Maps of the hydrogeologic terrains that are most likely to serve as recharge areas are being developed. These maps will be included to demonstrate the general area in which these settings can be found rather than to provide exact locations.

Offshore deposits are an important source of sand to replenish the lakeshore and to reduce the energy of waves approaching the shoreline. The strongest and fastest currents found in Lake Michigan are concentrated around the edge of the lake in a narrow breaking wave zone, starting in water depths between 18 to 20 feet deep and extending to the beach. This zone is also the location of the greatest volume of sand transport (littoral drift).

²⁸ Fleming et al. 1995. Atlas of Hydrogeologic Terrains and Settings of Indiana. Indiana Geological Survey Open –File Report 95-7.

²⁹ Id. P. 2.10

³⁰ Id. P. 2.11

³¹ Id. P. 2.18

³² Id. P. 2.16

Areas where development and facilities are dependent upon the use of, or access to, coastal waters or areas of unique features for industrial or commercial uses or dredge spoil disposal

Indiana's coastal region supports a diverse economy with international and national shipping, steel production, fishing industries, and recreational industries. However, Indiana's 45 miles of shoreline is subject to competition for space and resources from many of these interests as well as residential development and public access.

The CZMA gives priority to coastal-dependent uses related to fisheries development, recreation, ports and transportation, and the location, to the maximum extent practicable of new commercial and industrial development in or adjacent to areas where such development already exists.³³ Indiana's shoreline supports these coastal-dependent uses in some form including marinas, commercial and charter fishing, and ports and harbors. Many areas along the shoreline are of particular value for their contribution to coastal dependent uses.

The Indiana Port Commission manages the operation, maintenance, and expansion of Port of Indiana facilities. The Indiana Port Commission has articulated several planning principles for coastal-dependent uses. These include efforts to maximize use of existing facilities; reserve waterfront sites for waterfront activities; locate activities to minimize conflicts; maximize flexibility of use; and enhance water, road, and rail connections.³⁴ The Indiana Port Commission's planning process identifies ports and related facilities associated with waterborne transportation, docking and mooring areas, port loading facilities, and shipping channels.

An important component of harbor maintenance is the disposal of dredge materials. The ACOE is responsible for dredging certain harbors. In addition, representatives of IDEM and the Indiana Port Commission participate on the Great Lakes Dredging Team, a regional initiative to address the needs for dredging and dredge disposal. The policies and priorities of the Great Lakes Dredging Team may be used to identify areas for their value to the disposal of dredge material.

Urban waterfronts and vacant lands adjacent to the lake or connecting waterways are also areas of importance for the coastal region. Several important factors contribute to an area's significance for redevelopment including compatibility with existing zoning and land use; existence of easy access to modes of transportation, especially water; and existence of adequate utility systems. Waterfront revitalization involves the re- development of abandoned, previously developed lands along the shore and those areas in or near urban areas disturbed by past development. Revitalization can entail economic redevelopment as well as restoring environmental integrity and the visual and functional quality of the abandoned area. The revitalization of urban waterfronts also involves planning for integration with existing communities and the need to improve public access to the shoreline.

The cities of Gary, Hammond, and East Chicago were awarded federal funding from the U.S. Department of Housing and Urban Development as the Calumet Empowerment Zone in 1998. The Calumet Empowerment Zone will be administered through an Executive Committee and a

³³ CZMA Section 303(2)(D), 16 U.S. C. Section 1452 (2)(D).

³⁴Indiana Port Commission 1994-1996 Business Plan.

coordinating council that will implement their goals for economic, environmental, and social reform. The Empowerment Coordinating Council consists of representatives from the community, business, and government. The Calumet Empowerment Zone designation and administrative structure provides these cities the opportunity to identify areas where waterfront revitalization and connections to inland communities can meet their goals. To date, each city has designated a redevelopment zone under this program.

In addition, in the 2001 Indiana Legislative session, the Lake Michigan Shoreline Development Commission (IC 36-7-13.5) and the Shoreline Environmental Trust Fund were created. This Commission, which consists of local and state representation, can prepare a comprehensive master plan for development and redevelopment within the Lake Michigan corridor. These locally lead efforts may assist in identifying areas along the shoreline that are of particular value for their contribution to coastal dependent uses.

The shoreline of Michigan City, Long Beach, and Michiana Shores, also has additional local and county planning efforts for their portion of the shoreline. This primarily residential area includes Washington Park, several marinas and several service industry businesses such as restaurants. This portion of Indiana's shoreline has seen an increase in development to meet recreational uses as well as demand for residential housing.

Although the land-use of Indiana's shoreline may currently appear to be stationary; it is difficult to predict changes in ownership along Lake Michigan. Downsizing and changes in the steel-making process and other industrial shoreline facilities may affect the use of a percentage of currently industrial shoreline. In addition, inland communities may continue to work toward improving their connection to the shoreline through greenways and other transportation corridors.

Areas where if development were permitted, it might be subject to significant hazard due to storm, slides, floods, erosion, and settlement

Lake level fluctuations continue to occur in the Great Lakes. The level of each of the Great Lakes, including Lake Michigan, depends on the balance between the quantities of water received and the quantities of water removed. As the supply of water changes under natural outlet conditions in a lake, the lake-level and outflow adjust continually to restore a balance between the net supply of water to the lake and the outflow through its outlet. Lake levels affect extent of flooding, and shoreline erosion.

In addition to the natural process of the fluctuation of lake levels is the natural process of the transport of sediment, or sand, along the coastline. The waves and currents that transport sand are driven by wind. The intensity of storms on Lake Michigan plays a primary role in determining the amount of erosion that occurs in any year. Without storms, there would be no waves or currents to move large quantities of sand along the beach and lake bottom. Lake level affects whether waves attack low on the beach face when lake levels are low, or waves attack high on the back beach at the base of the erodible dune-bluff, when lake levels are high.

The ACOE described the early conditions of erosion on Indiana's Lake Michigan shoreline in a report completed in 1978 entitled "Report on Indiana Shoreline Erosion". The report details areas

along the shoreline in Lake, Porter, and LaPorte Counties where erosion damage occurred and projects future erosion damages. Areas that were identified as having a non-critical recession rate of less than one-foot per year include Marquette Park, Miller Beach, and Ogden Dunes. Areas where erosion was occurring at a rate greater than three feet per year include Indiana Dunes National Lakeshore, Beverly Shores, Indiana Dunes State Park, Porter and Dune Acres. Recession rates at Long Beach and Duneland Beach are not identified in the ACOE report. The areas with recession rates of greater than three feet per year extend along 13 miles of Indiana's 45-mile shore. However, these 13 miles of shoreline are designated natural areas where development is not likely to occur or areas that already are protected by structures. The ACOE concludes in the report that of Indiana's 45 miles of shoreline, only 2¼ miles are subject to critical erosion. While this early report provides a useful summary of past conditions on the Indiana shoreline, new construction, beach nourishment, and lake level fluctuations have resulted in changes in these conditions.

In order to plan for coastal development and protection of the shoreline, long-term records are needed for a reasonable estimate of the "background" erosion rates that can be expected for a particular portion of the shoreline. Erosion rates typically vary from high erosion to low erosion periods, determined by climatic "storminess," long term changes in "lake level," and the influence of sand availability due to man-made structures. Some years may see high erosion because of a combination of severe storm events, high lake level, and severe sand starved conditions. Some years may see low erosion because of mild storms, low lake levels and abundantly wide sand beaches. Averaging the episodes of high and low erosion should provide a fairly good estimate of "long term erosion rates" to allow a fairly accurate estimate of future erosion.

A High Erosion Hazard Area (HEHA) is a portion of the shoreline with a long-term erosion rate greater than one foot per year. The Indiana shoreline of Lake Michigan includes several HEHAs; however, many of the areas are currently protected from erosion by man-made structures or are included in the national lakeshore or state park where the shoreline is preserved in its natural condition. Although these HEHAs are protected or preserved they are considered Coastal Areas of Significance due to the need for maintenance or to better understand the coastal processes affecting these areas. The pattern of rise and fall of Lake Michigan is unpredictable, but there is no doubt there will continue to be significant changes in lake elevation. The storm events that occur during periods of high lake levels can cause the lake to have devastating impacts on the shoreline, sometimes regardless of the existing erosion protection.

High Erosion Hazard Areas in LaPorte County include areas located in Michiana Shores and Long Beach east of Michigan City. This portion of the shoreline has been protected by rock revetment in order to protect Lake Shore Drive. Seawalls have also been constructed by private homeowners. West of Michigan City, the National Lakeshore owns portions of the shoreline. Areas such as Crescent Dune and Mount Baldy are intended to remain as natural shoreline. Here, nonstructural methods of controlling erosion (beach nourishment) have been used in 1974, 1981, and 1987 and from 1996 through 2000. Beach nourishment is also planned for 2001.

High Erosion Hazard Areas in Porter County include areas located in Indiana Dunes State Park, Town of Porter, Dune Acres, Burns Harbor, Ogden Dunes, and West Beach. The HEHA identified on property owned by the Indiana Dunes State Park is maintained as natural shoreline. The HEHA

in the Town of Porter is just a short length of shoreline and although all of the shoreline owned by the Town of Dune Acres is a HEHA, only a minimal area is left unprotected by hard structures.

While only slightly less than one mile of shoreline extending west of the Burns Small Boat Harbor structure is considered a HEHA, the area contains some of the highest erosion rates on Indiana's coastline. The first 1,000 feet is owned by the Indiana Dunes National Lakeshore and is maintained as natural shoreline. During the March 9, 1998 blizzard, this part of the shoreline eroded 40 feet. This area has received beach nourishment in the past. In 2000, when the ACOE dredged the navigable channel of Portage/Burns Waterway, the clean dredge material was placed here forming a protective artificial dune bluff. The western portion of the shoreline covered by this HEHA is within the Town of Ogden Dunes. In 1997, a new seawall built by the State of Indiana further protected the eastern most homes. Some form of erosion protection now essentially protects the whole residential community. In addition, clean sand from the dredging around the NIPSCO Bailly power plant water intake in Lake Michigan is deposited on the outer sand bars at Ogden Dunes, providing sand to this sand starved area of Indiana's shoreline.

The easternmost portion of the Lake County shoreline near Wells Street Beach (on the county line) is designated as a HEHA. The only other location along the shore in Lake County that could be evaluated for erosion potential was Whihala Park Beach in Whiting. Very little of the shoreline in Lake County is designated as a HEHA because most of the shoreline west of Gary has extensive erosion protection structures constructed by the shoreline industries. Evaluation regarding erosion potential is not feasible in these highly constructed areas.

APPENDIX C: Existing Plans Incorporated into Indiana's CELCP Plan

- Marquette Plan principles, a comprehensive plan for securing green and public space along Northwest Indiana's lakefront. There are three guiding principles for the Marquette Plan, which were part of an agreement signed by officials from the five cities. First, 75 percent of the lakeshore should be recaptured and opened to public use. Second, land recaptured directly on the lakefront should have a minimum setback of 200 feet from the lake. Third, there should be a continuous biking and walking trail from the Illinois state line to the eastern boundary of the City of Portage for all Northwest Indiana residents to enjoy. Hard copy available upon request from DNR LMCP.
- The Indiana Dunes National Lakeshore Migratory Bird Habitat – Provides habitat information utilized by IBI model.
- Statewide Comprehensive Outdoor Recreation Plan (SCORP). The *SCORP 2000 – 2004 A New Millennium, A New Tradition* will be used as a guide by DNR to direct the allocation of Indiana's share of the federal Land and Water Conservation Fund. It can be found at: <http://www.in.gov/dnr/outdoor/planning/scorp/index.html>
- *The Coastal Historic and Cultural Resources Study of the Lake Michigan Watershed*: <http://www.in.gov/dnr/lakemich/pdf/historicstudy.pdf>
- IBI project for the Coastal Region identified areas at risk of conversion from natural state. The LMCP contracted with IUB for this study which was a modified IBI approach that incorporates "threat indices" to indicate natural areas with high potential for biodiversity. In the second phase of the study, natural areas were ground truthed, and the maps were presented to the public for input into the GIS models. The Study also incorporated Areas of Significance into the maps. http://www.in.gov/dnr/lakemich/activity/IBI_CELCP/IU_CELCP%20Phase%20I.pdf
- Northwestern Indiana Regional Planning Commission – *Greenways and Blueways Plan* <http://nirpc.org/Greenway%20and%20Blueway.htm>

APPENDIX D: List of PTW Members and CELCP Plan Meeting Participants

State Agencies:

Indiana Department of Natural Resources (DNR)

Steve Davis, Division of Water
Randy Brindza, Division of Fish and Wildlife
John Ervin, Division of Nature Preserves
Mike Molnar, Lake Michigan Coastal Program
Jenny Orsburn, Lake Michigan Coastal Program
Joe Exl, Lake Michigan Coastal Program

Indiana Department of Environmental Management (IDEM)

Joe Keithley
Linda Schmidt

Federal Agencies:

Scott Hicks, Indiana National Lakeshore
Elizabeth McCloskey, US Fish and Wildlife Service
Martin Jaffe, IL-IN Sea Grant Program

Local Government:

Reggie Korthals, Northwestern Indiana Regional Planning Commission (NIRPC)
Marybeth Wiseman, NIRPC
Craig Shillinglaw, NIRPC
Alan Resetar, Porter County Wildlife Management Advisory Board
Ed Melendez, Porter County Parks
Carl Fisher, Portage Parks and Recreation Department
Dorreen Carey, City of Gary, Department of Environmental Affairs

Non –profit Organizations:

Linda Cook, Association for the Wolf Lake Initiative
Paul Labus, The Nature Conservancy
Tom Anderson, Save the Dunes Council
Carol Cook, Save the Dunes Council
Charlotte Read, Save the Dunes Council
Jennifer Gadzala, Coffee Creek Watershed Conservancy
Sandy O'Brien, Sierra Club
Daniel Goldfarb, Wildlife Habitat Council

Industry:

Doug Bley, ISG Burns Harbor

Academic Institutions:

Young Choi, Purdue University Calumet
Mark Reshkin, Indiana University Northwest
Dr. Vicky Meretsky, Indiana University Bloomington